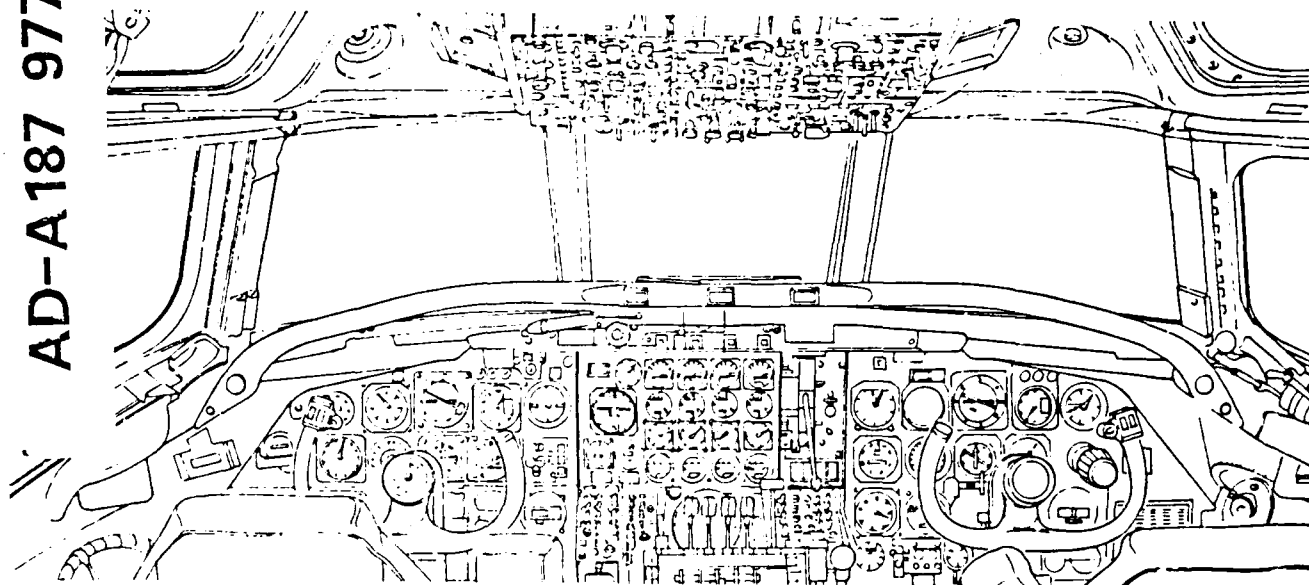


DTIC FILE COPY

FIRST ENCOUNTERS OF THE CLOSE KIND: ^①

AD-A187 977



THE FORMATION PROCESS OF AIRLINE FLIGHT CREWS

ROBERT C. GINNETT
LT COL, USAF

DTIC
ELECTE
NOV 24 1987
S H D

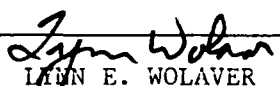
THE DEPARTMENT OF BEHAVIORAL SCIENCES
AND LEADERSHIP

UNITED STATES AIR FORCE ACADEMY

DISTRIBUTION STATEMENT A

Approved for public release;
Distribution Unlimited

87 11 10 100

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER AFIT/CI/NR 87-138D	2. GOVT ACCESSION NO. A187977	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) First Encounters of the Close Kind: The Formation Process of Airline Flight Crews		5. TYPE OF REPORT & PERIOD COVERED THESIS/DISSERTATION
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Robert C. Ginnett		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS AFIT STUDENT AT: Yale University		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS AFIT/NR WPAFB OH 45433-6583		12. REPORT DATE 1987
		13. NUMBER OF PAGES 260
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES APPROVED FOR PUBLIC RELEASE: IAW AFR 190-1 <div style="text-align: right;">  LYNN E. WOLAVER 260787 Dean for Research and Professional Development AFIT/NR </div>		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number)		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) ATTACHED		

First Encounters of the Close Kind:
The Formation Process of Airline Flight Crews

A Dissertation
Presented to the Faculty of the Graduate School
of
Yale University
in Candidacy for the Degree of
Doctor of Philosophy

by
Robert Charles Ginnett
May 1987



Accession For	
NTIS GRA&I	<input checked="checked" type="checkbox"/>
DTIC TAB	<input type="checkbox"/>
Unannounced	<input type="checkbox"/>
Justification	
By	
Distribution/	
Availability Codes	
Avail and/or	
Dist	Special
A-1	

© Copyright by Robert Charles Ginnett 1987

ALL RIGHTS RESERVED

ABSTRACT

FIRST ENCOUNTERS OF THE CLOSE KIND: THE FORMATION PROCESS OF AIRLINE FLIGHT CREWS

Robert Charles Ginnett

Yale University

1987

Members of airline cockpit crews often have never worked together or even met prior to their scheduled flight. While virtually all such crews accomplish their primary task, some crews operate better as teams than do others. One important influence on team functioning is the behavior of the crew's leader--the captain. Crewmembers report that they can determine how effective a given captain will be as a crew leader in the first few minutes of the crew's life. This research examined six captains who were effective crew leaders and four who were less effective. Data were collected both during the time of crew formation and during line operations.

The effective captains created multiple conditions for team effectiveness from the moment their crews first met. In initial briefings, for example, they affirmed the boundary of the group, discussed aspects of the work that required coordination (both within the crew, and with others), and fostered norms that encouraged teamwork. They

also lessened crewmembers' traditional dependence on the captain by actively engaging members in their briefings. Although each used different tactics, the team effectiveness strategies used in the briefings remained consistent throughout the life of their crews.

The less effective captains did not exhibit consistent team leadership strategies. Instead, each exercised control in ways that interfered with team effectiveness. Two of these captains inappropriately controlled their crews while the other two exhibited inappropriate control of their own behaviors.

The findings show that crewmembers import both information and expectations into the crew formation process. — In a short time, a captain breathes life into this imported "shell," thereby creating a working crew. Effective captains affirm and enhance the shell, while less effective captains abdicate or undermine it. — Implications of the findings for the design and leadership of teams in organizations are explored. —

PREFACE

I suppose there are doctoral students who know the subject area for their dissertation as they enter their doctoral program. There are probably others who come up with an idea while attending a course or seminar in midstream of their program. And some build their research around a method. This research has its roots in all of those origins but it truly evolved on its own. It incorporates interests that I arrived with in flying and leadership; concepts from classes that I found interesting and puzzling; and methods I was encouraged to learn about but never saw myself using.

This research would not have happened without the committee members who served. Collectively and individually, they influenced me and the path of this research. The committee members for this dissertation, Martha Miller, Victor Vroom and Richard Hackman, also served on my qualifying committee. I recall, in the final portion of that process, that I was asked about my plans for a dissertation. Having anticipated that question, I outlined a proposal incorporating all the traditions and rigor I had come to know in the course of my studies. I also recall the unanimous lack of enthusiasm with which the committee as a whole responded. "Yes," they said, "that kind of dissertation would be okay but we wanted to see something different from you." That meeting sent me back to the

beginning--which is what this research is really all about.

Individually, the committee members made invaluable contributions. Martha's advanced seminar introduced me to the subject and power of subtle behaviors and communication. Without that knowledge, I would have missed critical events that were going on around me in the group formation process. In keeping with the theme of the research, Vic redefined the task in one of the first committee meetings when he suggested that my early prospectus included sufficient goals for three dissertations instead of one. That critical event made completion of the research a possibility in the time frame available.

As the chairman of the committee, Richard deserves more credit that I can describe. His contributions range from the most abstract to the most practical. Conceptually, he helped me by reflecting and reshaping much of the confusing and seemingly contradictory data into concepts that made sense. He also understood the practical requirements for accomplishing research in an ongoing organization and he made things happen. But his ability for "seeing the big picture" never clouded his awareness of the value of detail. From the beginning thoughts of this research to the last "copy edit," he was a mentor.

There were many others who contributed to this project. Foremost were the airline executives, captains and crews who permitted me to observe and learn from their work. They are all professionals. The people associated with NASA supplied

more than just the funding. They were willing to support research that was looking for new issues and using new methods. Especially helpful were Clay Foushee at NASA Ames, John Lauber (now with the National Transportation Safety Board) and Bob Helmreich, a NASA researcher from the University of Texas. My friends and colleagues, both at Yale and at the United States Air Force Academy, freely shared their time, their thoughts, and a great deal of empathy, all of which were needed.

Finally are my appreciation and love to my family. Laura and Brad always helped me get my head back down to sea level from 35,000 feet. They were the real reality checks. But most importantly for our family was Sherry, who kept it going when I was gone for weeks at a time collecting data or when I sequestered myself for days at a time in front of the computer. Sherry, Laura and Brad also made this research possible.

TABLE OF CONTENTS

Page

iii	Preface
ix	List of Illustrations
1	Chapter I: The Problem
1	Overview
4	Introduction
17	The Research Questions
19	Group Research Literature
29	Research Approach
35	Author Notes
36	Footnotes
39	Chapter II: The Setting
39	Introduction
39	The First Day in the Life of a Crew
59	A Brief Guided Tour of the Aircraft, the Roles and the Norms
67	The Organizational Context
70	Summary
72	Footnotes

Page	
75	Chapter III: Methodology
75	Introduction
75	Selection of Captains to be Observed
78	Crew Characteristics and Demographics
81	Research Arrangements
87	Data Collection Procedures
94	Summary of Observations Conducted
97	Methodological Issues
110	Footnotes
115	Chapter IV: Results
115	Introduction
116	Early Group Formation
127	Results Unique to Groups and Individuals
196	Summary of the Results
207	Final Comments
209	Footnotes
214	Chapter V: Discussion
214	Introduction
214	Inappropriate Control: The Thread that Unravels Leadership Effectiveness in Crews
224	Toward an Integrative Framework
246	Footnotes

Page

247 Appendices

248 Appendix A: Letter of Instruction for Evaluators

249 Appendix B: Briefing Script for the Captain and
 Crews

251 Appendix C: Data Collection Sheet (Task)

252 Appendix D: Data Collection Sheet (Process)

253 Appendix E: Transcript of the Explanation of
 Research to a Crew

256 References

LIST OF ILLUSTRATIONS AND TABLES

Page		
38	Figure 1-1	Framework for small group performance
73	Figure 2-1	Cockpit layout for a Boeing 727-200
74	Figure 2-2	Forward instrument panel in a Boeing 727-200
111	Table 3-1	Number of Times Crew Dyads had Worked Together Prior to the Observed Flight
112	Table 3-2	Dates and Times of Crew Observations
113	Table 3-3	Block (Push to In), Flying (Take-off to Down) Times and Assessment of Demanding or Abnormal Flight Conditions
210	Figure 4-1	Plot of time (in seconds) for first and second briefings
211	Figure 4-2	Sketch of typical crew proxemics in a briefing
212	Figure 4-3	Plot of time (in seconds) that the crew members talked during the briefings for the A and B captains
213	Figure 4-4	Sketch of crew proxemics for Captain Bill's second briefing

CHAPTER I: THE PROBLEM

Overview

Everyday there are over 16,500 major commercial airline flights (DC-9, 737 or larger) departing in the United States (G. Mercer, personal communication, March 1986). Each aircraft is flown by highly qualified individuals with thousands of hours of experience. Further, each individual crew member has been screened by his or her¹ company's personnel system, undergoes recurring physical examinations and is routinely inspected by either Federal Aviation Administration inspectors or their delegates. These inspections include not only observations of actual line flying but performance on a variety of difficult maneuvers and emergency procedures in aircraft simulators. Such rigorous individual examinations and certifications (in conjunction with concurrent improvements in aircraft systems and instrumentation) have produced a transportation system unparalleled in safety. Even in the worst of years, flying in a commercial airliner is still many times safer per passenger mile than riding in an automobile.

Despite this remarkable safety record, investigations into the causes of aircraft accidents and incidents have yielded increasing evidence of a new problem. Indeed, the very fact that so much attention has historically been focused on the individual pilot may be a contributing factor in this latest aviation concern. This newest issue is the ability (or lack of ability) on the part of the individual

pilots on the flight deck to work effectively as members of a crew. Yet, every commercial airline cockpit is designed not for an individual pilot but for a team of pilots. The cockpit most typically will house a senior pilot in the left seat (the captain), a co-flying pilot in the right seat (the first officer) and a third pilot who does not fly but manages the aircraft systems (the flight engineer). In spite of this design configuration which requires crew work, little consideration has been given to the group in the cockpit. In fact, commercial flight crews are rarely intact working groups over time. At one extreme, members may work together for a month; at the other extreme, they may fly only from one city to the next and disband with little likelihood of working together in the near future.² It is not uncommon for airline flight crews to be made up of individuals who have never even met before. Yet within one hour of their meeting, they must work together as a crew in their task of transporting hundreds of men, women and children. In the broadest sense, it is the issue of group effectiveness in aeronautical environments which forms the outer bounds of the research at hand.

Beyond the obvious practical reasons for developing a better understanding of cockpit crews and their work, this context provides an excellent setting in which to look at more general issues in group behavior and performance. How do work groups form in a short period of time? What seems important in putting together a crew that can work

effectively? Are there differences in the levels of group effectiveness? Do the leaders play an important role? Do the leaders vary in their behavior over time? Are there behavioral differences between leaders of effective vs. ineffective crews? Are there similarities between leaders of effective crews? What strategies do effective leaders use? What is the impact of the organizational context and of the environment within which the organization operates? What impact does the organization have on the group's formation or performance? Not all of these questions can be addressed in this research effort; yet they all do lie within the arena for investigation when studying crews in organizational contexts.

One could devote years to the study of problems such as those listed above. The present effort has a much more limited focus, and yet it is a focus with at least temporal primacy. Specifically, this dissertation concerns the first few minutes of a crew's life--the group formation process--with specific focus on the behaviors of the designated leader that may foster, or hinder, crew effectiveness. The research attempts to exploit the intersection between theory and practice, generating knowledge about the functioning of cockpit crews that will be useful both for pushing forward basic research and theory regarding team performance and for improving policies and practice having to do with the design and management of air crews.

Introduction

It would be difficult to study the group formation processes of airline flight crews using as an analog college sophomores in a behavioral science laboratory. While the latter setting offers more control, it sacrifices the ongoing organizational context in which line performance normally occurs. Hackman and Morris (1975), in discussing the research setting and methodological strategies used in studies of group effectiveness point out that controlled laboratory settings "may themselves constrain the possibility of unearthing significant process-performance relationships." Often in social science experimental groups both task and norms are held constant thus "it is inevitable that the richness and diversity of interpersonal behavior within groups will be reduced substantially" (p. 59). The present research examines the focal issues within an operating airline organization.

Unfortunately, upon leaving the laboratory and entering the day-to-day world at work, one finds that powerful contextual variables come packaged together with an array of complications and unfamiliar (some might use the term "uncontrolled") situations. It often is the price one pays for "richness and diversity." While costs of this ilk should not deter behavioral scientist from pursuing in situ studies, there are certain difficulties. One cost that presents itself immediately in this study is that the

average reader (or even a frequent airline traveler) probably has little more than a casual understanding of what goes on behind the locked cockpit door. Similarly, a chance passing of uniformed airline employees in the lobby of a metropolitan hotel provides only the barest evidence that there is "group life" for an airline crew.

The remainder of Chapter I will be devoted to a discussion of the nature of the problem to be examined. After reviewing the specific literature on air crew performance and defining the domain of interest, the broader research literature on group performance and development will be considered. Because the cockpit and the organizational context of an airline company are rather unfamiliar research areas, something more than a review of the literature on group formation will be required if the ensuing methods, data, and discussion are to make sense. Therefore, a brief presentation of the organizational context, the physical setting, and the roles of the group members also will be provided. Chapter II will provide a rudimentary but hopefully sufficient description of the research setting at hand. At that point it should be possible to proceed in a more traditional manner with a description of the methods (Chapter III), the results (Chapter IV) and discussion (Chapter V).

General Nature of the Research

Crew work, and this research, fall within the broad

rubric of task group effectiveness. The most general form of the question is, "what is it that causes (or permits) some task groups to perform well while other task groups do not?" One can select almost any occupation where groups work and find a range of successes and failures. These can include production teams, baseball teams, fire fighting teams, or performing arts teams (Hackman, in press) to name but a few.

Yet one might question the appropriateness of a study of group effectiveness that focuses on cockpit crews. After all, don't most all commercial crews complete their assigned task of delivering passengers safely? The answer to this question is obviously, "yes." The fact that flights arrive safely is, however, clouded by many complex and overlapping variables which have an impact on the ultimate outcome. The industry as a whole has been the recipient of quantum improvements in technology, for example. From the development of "black box" electronics which monitor the overall performance of the aircraft hundreds of times every second to the near universal replacement of rough reciprocating engines with smooth turbine power plants, the aircraft has been vastly improved. Similarly, technological advancements have improved the management of the environment in which these modern aircraft operate. Air traffic control is now managed by computers which can predict air traffic congestion well before it occurs and thus provide flow restrictions so that the delays occur on the ground rather

than in the air. Systems are currently under development to further improve the pilot's information on navigation (i.e., Global Positioning Satellites), critical weather data (wind shear detection at and around airports), and collision avoidance systems.

With all this technology working for safety, perhaps one might be led to ask a different question: "What difference does it make if the crew works well as a team?" Increasingly, it appears that the answer to that question may be, "A lot of difference!" Despite the increased attention by the human factors specialists on the performance characteristics of the individual pilot, and despite the resultant technological improvements in cockpit design, about 65 percent of all accidents continue to fall into the human error category (Foushee, 1984). The impact of ineffective crew performance was also demonstrated in a comprehensive review of jet transport accidents worldwide between 1968 and 1976 by Cooper, White, and Lauber (1979). They found that breakdowns in the performance of the crew as a whole played a significant causative role in more than 60 of the losses studied.

Consistent with his concern for factors affecting group process and aircrew performance, Foushee notes an interesting etymological parallel: "Webster's New Collegiate Dictionary (1961) defines cockpit as 'a region noted for many conflicts.' Although this definition does not specifically apply to aircraft cockpits, it is

interesting to note how often interpersonal phenomena can affect air transport operations." If interpersonal phenomena can affect crew performance in the cockpit, then it seems reasonable to first examine what we know about air crew performance and then what we know about these interpersonal group phenomena.

Crew Performance on the Line

For a number of reasons, commercial airliners are crew served aircraft; i.e., there are at least two pilots in the cockpit. Historically, the workload inherent in operating a multi-engine aircraft was beyond the capability of a single pilot. No less important was the task significance associated with transporting human beings and the potential consequences to life on the ground in the event of individual human error. "As a direct result of the limitations and imperfections of individual humans, multi-piloted aircraft cockpits were designed to ensure needed redundancy" (Foushee, 1984). Also, the Federal Aviation Regulations (FAR 135.99) require at least a second in command if an aircraft is designed to carry more than ten persons. Yet despite these design and regulatory imperative, the majority of behavioral research in the airline industry has been directed at topics other than crew performance (Hackman and Helmreich, in press).

Historically, the airline industry and those responsible for its regulation have been primarily

interested in the qualifications and performance of the individual. Airline companies have traditionally hired many of their pilots from the military, which assured them some reasonably minimum standard of training and experience in flying modern aircraft. Other pilots hired by the major companies have had to demonstrate comparable levels of qualifications. Likewise, the Federal Aviation Administration (FAA) certifies individual pilots on their technical skills at flying the airplane (for the Captain and the First Officer) or at managing the aircraft systems (for the Flight Engineer). For example, pilots are asked to demonstrate (in simulator training) procedures for difficult and infrequently encountered conditions, such as steep turns, multi-engine failures, recovery from wind shear stalls on take-off, and go-arounds in poor weather conditions. Only in recent years, has this focus on the individual begun to broaden to include a view of the pilot as but one member of a crew.

Crew Problems in the Cockpit

What is a crew problem in the cockpit? We are not necessarily talking about difficulties in the traditional "group dynamics" sense. For example, in the cockpit, one might not expect to see the "learning group" phenomenon of leadership emergence with the resultant dependence and counter-dependence struggles. In an airline cockpit there is a clearly established and regimented authority structure

which dictates who the leader will be. This topic will be discussed in depth later; for now it is sufficient to note the specified hierarchy that places the captain as the clear authority figure in the cockpit. While this authority structure generally precludes problems of leadership emergence, it does not preclude related group problems that can lead to ineffective crew performance. Three examples from the aviation industry may provide some insight into the nature and diversity of crew problems in the cockpit.

1. The first example is taken from a National Transportation Safety Board investigation (NTSB-AAR-79-7). It illustrates both the pervasiveness of the captain's authority as well as the group's failure to demand that attention be focused on a critical aspect of the flight.

The crew of the Flight 173 had experienced only routine conditions as they brought the four-engine DC-8 into the Portland, Oregon traffic pattern. However, on final approach as they lowered their gear for landing, they heard a dull thump from what seemed to be the main gear area. The Captain elected to abort the landing and was put into a holding pattern until they could determine if there was a problem and whether or not it warranted further emergency precautions.

The aircraft proceeded in a large holding pattern while the Captain directed the crew in attempting to determine the possible cause of the noise. This pattern was maintained for approximately one hour at the Captain's insistence. During this time, both the First Officer and the Flight Engineer warned the Captain on four separate occasions that they were running out of fuel and needed to make a decision about landing. In spite of these repeated cautions, the Captain insisted that they continue to circle. Finally, as the first of the four engines flamed out, the Captain ordered the plane toward the

field while demanding that the Flight Engineer explain the cause of the engine failure. With all fuel tanks now dry, the other engines began to fail in sequence and the DC-8 nosed downward.

About 1815 PST, Flight 173 crashed into a wooded, populated area killing 8 passengers and 2 crew members, and seriously injuring 21 passengers and 2 other crew members. The National Transportation Safety Board determined that the probable cause of the accident was the failure of the captain to monitor properly the aircraft's fuel state and to properly respond to the low fuel state and the crew members' advisories regarding fuel state. This resulted in fuel exhaustion to all engines. Contributing to the accident was the failure of the other two flight crew members to fully comprehend the criticality of the fuel state or to successfully communicate their concern to the captain.

The Safety Board believes that this accident exemplifies a recurring problem--a breakdown in cockpit management and teamwork during a situation involving malfunctions of aircraft systems in flight. To combat this problem, responsibilities must be divided among members of the flight crew while a malfunction is being resolved...

Admittedly, the stature of a captain and his management style may exert subtle pressure on his crew to conform to his way of thinking. It may hinder interaction and adequate monitoring and force another crewmember to yield his right to express an opinion.

2. The second example, taken from an anonymous report submitted to the NASA/FAA Aviation Safety Reporting System (ASRS) (Foushee, 1982) describes a more blatant example of an overbearing and intimidating captain.

"I was the first officer on an airline flight into Chicago O'Hare. The captain was flying, we were on approach to 4R (a runway designation) getting radar vectors and moving along at 250 knots. On our approach, Approach Control told us to slow to 180 knots. I acknowledged and waited for the captain to slow down. He did nothing, so I figured he didn't hear the clearance. So I repeated, "Approach said slow to 180," and his reply was something to the effect of, "I'll do

what I want." I told him at least twice more and received the same kind of answer. Approach Control asked us why we had not slowed yet. I told them we were doing the best job we could and their reply was, "You almost hit another aircraft." They then asked us to turn east. I told them we would rather not because of the weather and we were given present heading and to maintain 3000 ft. The captain descended to 3000 ft. and kept going to 2500 ft. even though I told him our altitude was 3000 ft. His comment was, "You just look out the damn window."

3. This last example illustrates the tragic consequences of a captain from the other extreme--one who would not make a decision when one was required (NTSB-AAR-82-8; Burrows, 1982; Foushee, 1984).

"Slushy runway. Do you want me to do anything special for it or just go for it?" asked Roger Pettit, First Officer of Air Florida's Flight 90, as he peered into a snowstorm at Washington National Airport...

Unless you got anything special you'd like to do," quipped Larry Wheaton, the plane's 34-year old captain. Shortly after brake release, the first officer expressed concern with engine instrument readings or throttle setting. Four times during takeoff roll he remarked that something was "not right," but the captain took no action to reject the takeoff. (Air Florida operating procedures state the captain alone makes the decision to reject.)

Seconds later, Flight 90 came back down, hitting the 14th Street Bridge before it crashed into the ice covered Potomac River, killing 74 persons on the aircraft and four motorists on the bridge.

The NTSB ruled that the captain of the aircraft did not react to the copilot's repeated, subtle advisories that all was not normal during the takeoff. Moreover, in recommending that pilot training include "considerations for command decision, resource management, role performance, and assertiveness," the Board implied that the copilot's lack of assertiveness (possibly induced by the inherent role structure of the cockpit) may have been a causal factor.

These three cases describe ineffective task group behaviors at the extremes. Two of the three incidents resulted in accidents and one in an apparent near miss. In spite of the advanced safety systems on board these aircraft, they could not compensate for a lack of effective group work.

Several of the major airline companies have recognized the importance of teamwork in the cockpit and have initiated programs to improve group performance. For example, United Airlines started a program in 1981 entitled Command/Leadership/Resource Management (CLR) which was designed to improve overall crew effectiveness. The following paragraphs, which illustrate the company's awareness of the needed shift to a broader training focus, are taken from United's introductory volume in CLR training (United 1981).

Historically, pilot training has focused on flying skills and systems knowledge while neglecting or ignoring such factors as how pilots communicate with one another, the process of decision making and cockpit resource management.

The days when the pilot climbed into a single seat cockpit, took off into relatively empty skies, navigated with primitive nav aids, no ATC interference, and flew by the "seat-of-the-pants" are long gone. And while the traits and skills which kept the early aviator alive are just as necessary today, new dimensions have been added to the pilot's job which require additional skills.

Today's pilot not only has to be a skilled aviator, but just as important, must be skilled in working with others in effectively managing all available resources... The relationship between the pilot and the airplane is becoming similar to that between a manager and his subordinates. As a general rule, managers do not do the work of their

subordinates. Instead they set goals, develop plans, make decisions, anticipate problems, adapt to changes and correct errors. In other words--- they manage their resources.

Leadership in the Cockpit

Intuition, as well as a wealth of literature (e.g., Fiedler 1967; Vroom & Yetton 1973; Bass & Valenzi 1974; House & Mitchell 1974;) would suggest that the leader plays an important part in the group's performance effectiveness and general level of interaction. The impact of leadership has been noted in groups ranging from therapy and learning groups to experimental groups and organizationally imbedded task groups.

In the cockpit, the captain is the leader--both by tradition and by regulation. There is no question where the authority lies: the captain is (or at least is expected to be) in charge. Federal Aviation Regulation 91.3 states "The pilot in command (i.e., the captain of a commercial aircraft requiring more than one pilot) of an aircraft is directly responsible for, and is the final authority as to, the operation of that aircraft."

So strong are the norms surrounding the authority of the captain that some first officers will not take the airplane from the captain who is flying even in the event of impending disaster. In an investigation conducted by Harper, Kidera, and Cullen (1971) at a major air carrier, captains feigned subtle incapacitation at a predetermined point during final approach in simulator trials

characterized by poor weather and visibility. In that study, approximately 25% of these simulated flights "hit the ground" because, for some reason, the first officers did not take control. This finding suggests that the authority dynamic surrounding the role of the captain must be extremely powerful. So if there is variance in the way crews work together, and the captain occupies such a powerful role for all aspects of the crew's performance, does it not seem reasonable to look first at the captain for some understanding of the phenomenon?³

It is generally recognized in air transport organizations that there is substantial variation in the way captains run their crews (i.e., some captains are good crew managers/leaders and some are not); and that effective and less effective captains can be reliably identified.

Helmreich, Foushee, Benson and Russini (in press) asked Check Airmen⁴ to make free choice evaluations of the ten best or ten worst "cockpit managers" among captains with whom they had direct experience. Of the rated individuals, there were discrepant ratings (defined as appearing on one evaluator's "best" list and any other evaluator's "worst" list-or vice versa) for only three 149 captains.

Additionally, numerous discussions with first officers without exception yielded the same information: there are notable differences between captains in how they run their crews. The following interview is typical:

RCG: Are all the people you fly with pretty much the same?

Pilot: Oh no. Some guys are just the greatest in the world to fly with. I mean they may not have the greatest hands in the world but that doesn't matter. When you fly with them, you feel like you want to do everything you can to work together to get the job done. You really want to do a good job for them. Some other guys are just the opposite...you just can't stand to work with them. That doesn't mean you'll do anything that's unsafe or dangerous but you won't go out of your way to keep him out of trouble either. So you'll just sit back and do what you have to and just hope that he screws up.

RCG: How can you tell which kind of guy you're working with?

Pilot: Oh, you can tell.

RCG: How?

Pilot: I don't know how you tell but it doesn't take long. Just a couple of minutes and you'll know.

This illustration points directly to the critical issue for this dissertation. This first officer, like numerous other pilots, said it did not take long ("only a couple of minutes") to determine whether the captain they were to work with was good or bad from a crew management perspective. The preceding interview was also characteristic in another way. Even though crew members felt confident of their ability to judge captains' relative prowess at crew management in a very short time, they did not know, or at least were unable to articulate, how they were able to make this determination. In other words, they did not know exactly what the behavioral differences were between effective and ineffective crew leaders, but whatever they were, they were there early on in the group's life.

The Research Questions

Question One: What Do Captains Actually Do in the First Few Minutes of Their Crew's Formation?

We should be able to systematically observe the formation process of a number of real groups in a real organization coming together to perform a real task--and for all intents and purposes, the same task. While all of the individual members will be trained to perform their tasks and will have some level of experience at performing them, most of the teams will have never worked together before. What happens in the critical group formation period one hour before takeoff and, most importantly, what does the captain do early on in the group formation process? Will a captain tend to have a consistent style he uses or will he vary? Will he become involved with the members and them with him or will the "group" remain a set of individual and interchangeable parts?

Question Two: Do Captains Who are Known for Their Abilities in Effective Crew Management Behave Differently than Their Less Effective Peers During Crew Formation?

A critical portion of this research will be to determine if there are any early differences between the captains who are known to be particularly good at developing, leading and managing an effective crew and those who do not possess a high amount of these skills. Do

effective captains give more lengthy briefings? Do they focus more on descriptions of the task to be performed (or certain elements of the task) than do their counterparts? Do they expand the task beyond what might minimally be expected? Do they consider the boundaries of the group either physically or psychologically? Do they subdivide the group or expand it? Since the behavior of the group would seem to be irrevocably tied to the norms, are there any differences between the two groups of captains in how they establish and transmit the appropriate norms for effective group work (and what might they be)? If, as noted earlier, the authority dynamics toward the captain are so marked and unidirectional, how do the effective captains behave regarding their authority? Do they exercise their legitimate authoritative rights or do they tend to moderate the traditional impact of this variable on the crew's behavior? If so, how do they accomplish this? Are there observable data in the early moments of the group's life that will enable crew members to assess a captain's relative ability to lead and manage a crew?

Question Three: Does There Appear to be Any Consistency
Between the Formation Process and What Happens in Subsequent
Line Performance?

Lastly, and to a much less detailed extent, what other behaviors exhibited by the captain over the life of the group might impact the group's performance? How will they

tend to handle problems that arise in the normal course of line flying? Will they change their behaviors in response to changing demands or will they remain consistent with the patterns established in the early moments of the group? Since the captain is usually the most experienced member of the group, how will he share his knowledge? And finally, are there any consistent patterns exhibited by these groups of captains in their "out-of-cockpit" interactions with the crews?

Group Research Literature

Having already considered literature from aviation psychologists and investigators of aircraft accidents, it is now appropriate to examine that portion of the literature on group performance most immediately relevant to the present problem--namely, the literature on group development and group formation. If we were to examine the literature according to the temporal ordering of the group flow, we would start with the research on the formation process and move toward performance. But to do so in the literature would be to proceed from a narrow topic (group formation) to a much broader topic (group performance). Therefore in order to properly narrow and focus the search, we will move from relevant research on the topic of group performance to group development and on to group formation. Of particular interest will be any research examining the leader's behavior in group formation and any relationships between

the leader's early behavior and subsequent group performance.

Group Performance

Literature on this topic abounds both in volume and range. One of the early reviews of the research on the performance of small groups was compiled and integrated by McGrath and Altman (1966) and updated again by McGrath (1983). Consistent with this integration is a framework developed by McGrath (1964) and adapted by Hackman (1986). This framework is depicted in Figure 1-1.

Insert Figure 1-1 about here

Hackman (1986) notes that this framework has been particularly useful in organizing, summarizing and integrating the empirical research on group behavior. Beyond overall patterns of group process (Bales, 1950; Bales & Cohen, 1979) and group development (Hare, 1976; Tuckman, 1965), Hackman shows that the links between the various categories can be useful in categorizing what is known about group performance. He cites research on the input-process link focusing on the group composition (Schutz, 1958; Thomas & Fink, 1963) and on member personality (Bales, 1970); and on the process-outcome link emphasizing the impact of group

interaction on the attitudes, beliefs and behaviors of individual group members (Hackman, 1976) and on the ways that interaction shapes the outcomes of group decision-making and problem solving (Janis, 1982; Myers & Lamm, 1976; Nagao, Vollrath & Davis, 1978). There has also been considerable research on the direct input-output relations.

Because the current research is concerned with the effectiveness of organizationally embedded task groups, the preceding research has utility. Particularly important are those studies that describe the impact that the environment, organization, and group can have on the beliefs, attitudes and behaviors of individual members.⁵ But since the focus of this research is on the role of the leader during the early development of the group, we must examine in some depth the literature on group development processes, and on the role of the leader during group formation.

Group Development

Group Dynamics

Researchers who study groups from the "group-as-a-whole" perspective recognize the importance of group formation processes. The majority of analyses from this perspective emerge from either self-study or therapy groups. Thus they are considerably different, at least superficially, from the task group of a flight crew in both objectives and longevity. However, given that a fundamental assumption of the "group-as-a-whole" theorists is that the

sequence of issues and activities that emerge in groups as they progress from origination to termination is universal (although often masked by the overt devotion to the task), it is worth reviewing the findings from this perspective.

Theorists who have examined the group formation process (such as Bion, 1961, Scheidlinger, 1964, Dunphy, 1974, and Gibbard, 1974) recognize that there is considerable anxiety associated with joining a group. In general, this tension is attributed to an unconscious ambiguity between a fear of being engulfed or obliterated by the group and the opposing fear of being excluded or separated from the group. This ambivalence toward a single object (in this case, "the group") is psychologically uncomfortable and creates energy devoted toward resolution.

One approach to explain the mechanisms for resolution of this tension has evolved from the work of Klein (1946) and Mahler (1972). Their work suggests that the processes of "splitting and projective identification" reduce the tension of ambiguity. Jacques (1955) and Wells (1980) have applied this perspective to group analysis, suggesting that adults often use the same coping strategies as used by infants--strategies that result in excessive role differentiation and scapegoating. Gibbard (1974) has noted that these strategies serve both defensive and adaptive functions. Role differentiation, for example, can help the group localize and isolate conflicts while at the same time oversimplifying and distorting its emotional life. At this

point, neither the extent to which these dynamics are exhibited by flight crews, nor their impact on crew performance is known. While such behaviors might be expected to be harmful in long term group relationships, it is possible that they could provide an efficient process mechanism for such short-lived task groups.

Recent findings by Gersick (1983, 1985) suggest that there may be a flaw (or at least a lack of universality) to one of the fundamental assumptions of the group-as-a-whole theorists--namely, that groups progress from one developmental phase to the next phase of group life in an orderly, predictable way. Gersick found a rather different developmental process. Her studies of a variety of time-bounded task groups in organizational settings revealed that groups typically spent the entire first half of their lives on the course that was established in the first meeting. Although what happened in Gersick's groups varied depending on the conditions at the first meeting, all of the groups studied stayed with their initial plan until almost exactly half way through the total amount of time allotted for completion of their work, at which time a major upheaval and transition occurred. These findings attest to the significance of first meetings even as they cast serious doubt on the generality of textbook models of group development that posit orderly movement through fixed stages.

Impression Formation

The work from social psychology most relevant to the present research is that on impression formation--especially the mechanisms and effects of impression formation in pre-existing social structures. It is unlikely that the crew meets an unknown captain in a totally passive and objective manner. Instead, members enter the situation with some impressions of captains in general and these existing cognitive structures filter, organize, and interpret data about a previously unknown captain. These existing cognitive structures are commonly referred to as schemata (Fiske & Linville, 1980; Fiske & Taylor, 1983)

Since the pre-existing structures are used here in handling information about a broader social group (captains) they can be labeled role schemata. The benefit of role schemata is that they simplify a complex world, thereby reducing the amount of cognitive effort required in new situations. One does not have to process every data point about every new captain encountered. Indeed, if a first officer were asked to describe what he knew about a captain whom he had yet to meet, his schemata would probably include a wealth of generally accurate information (time with the company, hours of turbine time, certifications, qualifications, and so on). Yet schemata may be quite incorrect in particular situations. Such is the nature of stereotyping and prejudice. Even so, schemata provide

structures for simplifying a complex world and may help to speed the process of assessing a new leader, especially where time is limited.

The Importance of Early Group Life

In his chapter on systematic observation, Weick (1986) discusses the "drama of small events" as representations of larger social events. As he notes: "The first five seconds (Schegloff, 1968), the first five minutes (Pittenger, Hockett & Danehy, 1960), the first fifteen minutes (Labov & Fanshel, 1977) of therapeutic exchanges or small group discussions (Rosa & Mazur, 1979) contain in compressed form all of the themes that will be replayed for however long those exchanges continue." Weick goes on to point out that these small beginnings may not simply reflect larger events; they might actually become the larger event through a process described as deviation amplification. This process in turn can be used to explain the mechanism for self-fulfilling prophecies.

Therapeutic sessions were also the setting for Gendlin's (1981) report that the final success of years of psychotherapy, regardless of approach or technique, could be predicted accurately very early in the process. "We found we could predict success or failure right from the start just by analyzing the early interviews. According to a careful statistical analysis, there was less than a thousand-to-one chance of getting the same finding

accidentally." Again, even though these studies of therapeutic or learning sessions point toward the importance of early group life, the results should not be directly extrapolated to the first meetings of work groups in ongoing organizational settings. Instead, the potential importance of the first meeting of the individuals who comprise the task group should be considered in light of the wealth of information regarding roles and norms that each member imports from the organizational and environmental context.

The Formation of Task Groups

Since this research does concern real work groups in an actual organization with a specific and consequential task to perform, it is perhaps most fitting to examine a task based theoretical model. One such model, which also recognizes the importance of the first meeting comes from the normative approach to work group effectiveness proposed by Hackman (1986). After outlining the utility of a normative model and defining such a model for work teams, Hackman moves toward an action model for improving group effectiveness.

The steps outlined for "helping a team get off to a good start" seem particularly relevant for an assembling flight crew. These include (a) the development of boundaries, (b) coming to terms with the task, and (c) development of the norms to guide group behavior. Even though the boundaries are somewhat established and "a task"

is already defined when a group is created, there is plenty of room for further management of both. Similarly, each group imports some definition of group norms and member roles, but these are subject to modification as well.

The normative approach to group performance invites one to view leadership in terms of the functions that need to be performed to create positive performance conditions (Hackman & Walton, 1985). In a flight crew, there is a single legitimate authority (the captain) and his or her behavior is undoubtedly critical. But his is not the only leadership behavior (i.e., others can also provide meaningful leadership), nor is it necessarily unidimensional.

In addition to explicitly defining the boundaries, tasks, norms and roles, leaders (either formal or informal) can engage in behaviors that creates conditions such that the contributions of the other members are encouraged and valued. In essence, leadership of the group is defined as functional behavior rather than in terms of traits or skills inherent in any one person.⁶ These behaviors, or the conditions which precipitate their emergence, may be expected to appear early in the life of the group. And while these functions might be performed by any member, at this point it seems reasonable to focus on the captain.

Hackman and Walton (1985) specifically examined the role of the legitimate leader in organizational work groups while maintaining a functional approach to leadership. This design draws explicitly from McGrath's (1962) definition

that the leader's "main job is to do, or get done, whatever is not being adequately handled for group needs." One important area where a knowledgeable leader can help fulfill a number of critical functions is at the first meeting. In addition to the three functions described above, the effective leader might also take advantage of the opportunity to educate the group or to diagnose problems and opportunities the group might encounter.

Summary of the Research Literature

The relevant literature on group formation, development, and performance suggest several important issues for this research. First, the organizational context is important for both the formation and performance of task groups. Secondly, from both the fixed stage perspective of group development as well as from recent work on time-bounded groups, we learn that the beginning is a most important period in the group's life. Other research has shown that the early moments in the formation process are predictive if not causative of subsequent performance. And finally, a normative model for group effectiveness has suggested several key factors for helping a group get off to a good start--factors which we might expect to see initiated by group leaders during the early moments of a group's life.

Research Approach

The Domain: Group Work in the Cockpit

Airline cockpit crews perform tasks. Within that five word sentence are the key restrictions on the domain of this research. First, cockpit crews are real groups in a social system of human beings. Following Alderfer (1977), a "group" is viewed here as:

...a collection of individuals (1) who have significantly interdependent relations with each other, (2) who perceive themselves as a group by reliably distinguishing members from nonmembers, (3) whose group identity is recognized by nonmembers, (4) who have differentiated roles in the group as a function of expectations from themselves, other group members, and nongroup members, and (5) who, as group members acting alone or in concert, have significantly interdependent relations with other groups.

Secondly, cockpit crews have tasks to perform that result in a discernible and measurable product. Even though the cockpit door is closed to passengers during flight, most travelers would agree that the three people in the front must be doing some tasks to insure that the aircraft departs, flies and arrives safely. And lastly, because they are airline cockpit crews, they operate within the bounds of some organizational context.

These restrictions simultaneously simplify the research task and make it more difficult. By narrowing the range to include only task groups in organizations, certain problems of ubiquitous application to all groups in all situations are eliminated. This research simply does not apply to all

kinds of groups nor will it consider all aspects of the groups it does examine. On the other hand and as noted earlier, in order to examine a group in an organizational context, one gives up certain advantages of the laboratory setting. One of these is clearly differentiated and measurable effectiveness criteria.

In the broadest sense, there are measurable performance criteria for airline crews but they are so routinely achieved as to become nondiscriminatory in terms of relative effectiveness. As one airline official stated, "at the end of the day we want the number of takeoffs to exactly equal the number of landings." They usually do, and hence, there is no variance in that criterion. A broader view of team effectiveness (e.g., Hackman, 1986) does provide criteria on which variation across crews is likely to be observed. Specifically, an effective crew would be one for which (1) the productive output of the crew meets or exceeds the performance standards of the people who receive and or review its output, (2) the social processes used in carrying out the work should maintain or enhance the capability of members to work together on subsequent tasks and (3) the group experience should, on balance, satisfy rather than frustrate the personal needs of crew members. According to the check airmen who review the performance of crews, there is indeed variation among crews along these dimensions.

The Present Focus

The First Few Moments

Since crews are not intact work groups over time but form afresh for each trip, captains have an opportunity to establish the conditions (within the organizational context) for any particular crew as it forms. If there is variation in crew performance and if it is a function of the conditions created by the captain, then whatever the captain does early in the group's life should have an important bearing on its eventual effectiveness.

That captains play an important part in the overall effectiveness of the crew should come as no surprise given the authority inherent in their role. Likewise, there are important functions the leader can play in creating the performance conditions that support effective group work--for example, by defining or redefining the task, by altering the boundaries of the group, or by developing and maintaining the group norms that are appropriate for the work to be accomplished.

Check airmen could quite reliably select those captains who were effective at the task of managing their crews as well as those captains who were ineffective at that task, but could not describe what behaviors each category of captain used--especially for the behaviors in the early moments of crew formation. This was an important factor in determining the course of the research. It would be both

interesting and useful to know how effective captains form a group and what differentiates them from those who are less effective. If it is assumed that whatever these captains do is not mystical but behavioral, then a trained and experienced observer should be able to detect the behaviors responsible for their relative effectiveness. Furthermore, since the check airmen could reliably assess the effectiveness of certain captains, their collective judgment make an ideal criteria against which the various observed behaviors could be evaluated.

Critical Events Beyond the First Few Moments

For a number of reasons, the research period was not restricted to just the critical early minutes. First, it would be interesting to see what happens during line operations after the briefing. Secondly, if the researcher were only present for the briefing, the reactivity of the captain and the crew might have been heightened in that period of time. At this point that is not to say that there was no reactivity to the researcher's presence (a point to be addressed in Chapter III) but the reactivity should have been no higher for the briefing than for subsequent crew behavior. Thirdly, this research is part of a larger project to study crew performance in aeronautical environments, of which the crew formation process is only one part.

Since the data collection methods for ongoing cockpit

observation of crew performance were under development it was determined that only critical incidents of either a task or process nature would trigger intense data collection efforts in the cockpit or at other observed periods in the crews' life.

Strategy

How will we go about answering these questions? While a detailed answer as to the specific methodology will come later, it seems appropriate to introduce the general strategy now. Since the check airmen were aware of the relative qualities of captains, the strategy was to have them generate a list of those captains who fall into the two extremes. From that list, names would be provided to the researcher who would schedule crew observations periods. To protect against experimenter effect, the researcher/observer would not be told whether any particular captain had been categorized as effective or ineffective. Using a variety of methods, the observer would record in detail the early group formation process. He would then travel with the crew through a portion of their line flying duties and record critical events there and in other out-of-cockpit portions of the crew life. Originally, three observation of each captain were planned in order to assess the impact of other factors such as differing crews, weather patterns, time of day, and so on. After the observations were completed, the tape recorded data from the briefings would be transcribed

and content analyzed for information on tasks, boundaries, and norms as well as any other significant behaviors or communications. The transcripts would also be separated by the captain's effectiveness category and analyzed for patterns. Similarly, sketches made of the locations of people in the briefings would be analyzed after segregating them according to the effectiveness criterion described above. Lastly, the logs of the flying observations and out-of-cockpit incidents would be examined for consistent behaviors contributing or detracting from effectiveness.

Having briefly introduced the objectives and strategy, it is now most appropriate to introduce the reader to this somewhat unknown research setting in order to make more meaningful the details of the methodology and the results.

Author Notes

The research reported here was supported by Cooperative Agreement NCC 2-324 between NASA and Yale University.

Footnotes

¹ The researcher is aware of, and wherever possible, supports Section 2.12 of the Publications Manual of the American Psychological Association regarding use of nonsexist language. However, in the cockpit crews observed for this research (both during the preliminary studies and in the major study), there were no women. For ease of reading and as a reflection of the facts, masculine pronouns are often exclusively used.

² One major international carrier claims that if two cabin crew members work together on a given flight, the best estimate of the time that will elapse before they will be paired again is five and one-half years.

³ This is not to suggest that the individual crew member can or should give up his own responsibility for effective group work. Indeed, part of the CLR training mentioned earlier includes assertiveness training for subordinate crew members. This merely is to suggest that the importance of the captain's behavior is an important aspect in the group's performance.

⁴ Check Airmen are pilots who are certified by the FAA to conduct both line and simulator evaluations of fellow pilots within the company.

⁵ Hackman (1976) draws on the literature on social influence as well as the literature on group process in making this case.

6 A similar approach to leadership was suggested in the four-factor theory of leadership (Bowers & Seashore, 1966).

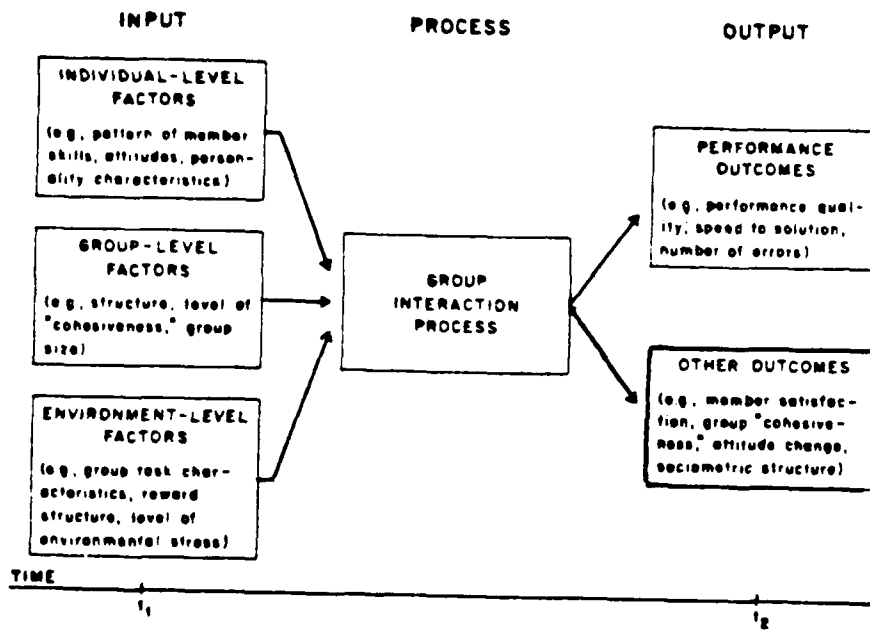


Figure 1-1 Framework for small group performance
(Hackman, 1986).

CHAPTER II: THE SETTING

Introduction

Even the most frequent flyer among airline passengers normally gets on an airplane at one airport and departs at his or her destination with perhaps a connection or stop enroute. This experience provides little insight into the daily work routine of the crew (or crews) that operate the aircraft. This chapter is intended to bridge that experience gap. The first section takes the reader through a narrative of a typical first day in the life of an airline crew. Section two defines the nature of the cockpit, the roles of the key players and the major influences on crew behavior at a conceptual level. The final section examines the typical organizational and extra-organizational contexts in which the crews operate.

The First Day in the Life of a Crew

At 0450, Captain Al Burland was waiting for the shuttle bus that would take him from the remote crew parking area to the terminal. He was a little early because the New York traffic had been lighter than he had expected but that was okay. He preferred to have too much time for crew preparation than too little. There were others waiting with him in the warm but gusty predawn air: two other captains (one of whom he recognized as a Check Airman), two first officers, four second officers and a variety of flight attendants and ground crew members. He had seen some of

these other employees around the terminal but he had not worked with any of them before.

The bus rolled in on time which was somewhat of an unusual circumstance. No one was able to figure out exactly what the published bus schedule meant since it seemed to be only slightly correlated with the arrival and departure of the vehicles themselves. These erratic shuttles tended to be an irritant to Al because it sometimes caused one of his scheduled crew members to be late and he liked to have everyone there for the briefing. Takeoff today was scheduled for 0700 with a 0600 show time. Maybe the ontime bus performance would hold up until all of his crew arrived today.

After the ten minute ride to the terminal, Al entered through the northern most doorways and went directly to Flight Planning. As he struggled with his suitcase and overcoat in order to punch in the digital code on the security lock, he could see that the room was already a beehive of blue suited crew members. Inside the door he placed his bag under a desk and headed for the counter at the far end of the room, pausing to scan the national weather summaries clipped to the wall. It appeared that most of the east coast was clear in spite of the 30 knot gusts blowing outside, but there was a cold front over the western region of the country that might bear watching for tomorrow's trip to Chicago.

Thumbing through the dispatch releases at the counter,

he didn't find the envelope with his name printed on it. That probably meant one of three things: (1) he was too early and it hadn't come up from dispatch yet; (2) one of his fellow crew members had already picked it up; or (3) the computer tie line had been down and flight plans were backed up. As he turned around, a young looking second officer walked up and said, "Are you Burland? I'm Jim Sweeney. I'm on the Pittsburgh trip with you." After introductions were completed, the engineer explained that he had gone over the paperwork and everything looked okay. They both reviewed the "Hot Read" file of the latest flight related information, which included a NOTAM (Notice to Airmen) on the parking ramp construction at Miami International, their first destination.

Al asked about Jim's background as they headed to a crew room to meet the remainder of their team. Jim had recently separated from the Navy where he had been flying carrier based F-14's since graduating from Ohio State. He had loved flying the hot fighters, but since his marriage he had become disenchanted with the frequent sea tours. Al knew that Jim had to be a good pilot to even be selected for Tomcats. Just putting one of those jets down on a pitching carrier was a job he was glad that others did for a living.

At 0550, Al and Jim found their four flight attendants seated at a table talking with the First Officer, Dave Stewart. Dave had been on a trip with some of these flight attendants before, but he was the only member of the flight

crew who had. Like Jim, he had never met Al Burland before. Dave stood and spoke with Jim and Al for several minutes passing on some information he had checked on concerning the anticipated load and the departure gate.

Two minutes before scheduled show time, Al Burland sat down at the table with the four flight attendants as Dave and Jim moved around behind the group and faced Al. "Okay, let's get started here. I'm Al Burland, Dave Stewart over there is our first officer and Jim Sweeney will be our flight engineer. I don't know any of you so if you could tell me who you are, I'll write your names down." Each of the four women introduced themselves and then Al repeated each of their names as he went back around the table. He then sat forward in his chair and began to speak.

"I'd like to talk to you a little about what we're going to do. Our first objective is to be on time. That might not always be possible because of the weather but we're going to try. While we're talking about this, I'd like you all to stay down when I turn the No Smoke sign on in this wind."

"How is the weather?" asked the flight attendant who would be acting as the lead attendant for the day. This duty, which typically rotated among the assigned flight attendants over the course of a three or four day trip, carried with it the title of the "A" Flight Attendant.

"Well, right now it's not really, really bad but until we get up to about 5 or 6 thousand feet it's probably going

to be bumpy. And also the same on the way down. I'll give you ten minutes on the No Smoking sign on landing. And I'll do that on every leg whether we're real full or whether we're real light. That's a long time but I do that so you can make a good safety check and be in your seats well prior to our landing. So ten minutes again, make sure you do a good safety check and then go ahead and get in your seats. The reason I do that is because I had a Fed riding with me one day and he was real upset because he could hear the girls back there rattling around below 500 feet. So when that sign comes on, whatever you're doing, stop at that time and put everything away and get in your seats. And also, sometimes it takes a little bit of adjustment to get used to because I guess a lot of captains don't do that. But I'll give you a good ten minutes unless for some reason we get vectored in and we're coming in early and then we'll have you come up and we'll tell you."

"Does anyone have a copy of our schedule for this trip?" asked another flight attendant. The Flight Engineer handed her a scrap of paper with the information printed on it.

"Oh yeah, how about the flight time to Miami?" asked the A-attendant.

Al replied, "Ah, I don't have that right in front of me. Jim has the flight plans so he can look it up for you. And today with the winds being what they are there'll be single runway operations so I think we'll probably take a

little longer so you'll have even more time on the short legs up to Boston and back. If we have any problems throughout the flight I'll let you know what our intentions are up front, what we're going to do and our destination if that changes. By the same token, if you guys have any problems back there, either with a passenger, or if something doesn't look right, let us know. You guys have been around enough, if it doesn't sound right or whatever, please come up front and we'll let Jim go back and take a look at it. It could be something important. And even if a passenger says something's not right with the airplane, let us know, okay. You know on one flight, a passenger told one of the cabin crew that he saw part of the airplane fall off in flight, which in fact it had. And her answer to him was, 'Yes, the Captain knows about it.' In fact, the Captain didn't know about it, as we all know. So even if a passenger says something, some of them are really pretty knowledgeable. And also we'll send Jim back to look at it just to give them a warm fuzzy feeling in their stomach that somebody comes back and says everything's ok."

"Okay." responded the A.

"Okay. Ahhh, you guys can board whenever you're ready. No need to ask us up front. And the same way, you can bring up the stairs after the people are on board, you don't need to ask. In both of those cases, if we don't want you to either board or bring up the aft air stairs for whatever reason, mechanical, whatever, we'll come tell you. Ahhh

boy, on the other side of the coin, don't let the ground people rush you. If you guys aren't ready to board and they're trying to hurry up, have 'em come talk to me."

"Okay, thank you very much. Would you like the door open when you taxi?"

Al paused briefly and then replied to the question. "Ah, I like it open and I'll tell you why, because that way if we get a real quick taxi, I can look back and kind of pace ourselves, so that we're not pulling on the runway then with the tower expecting us to go right away and you guys aren't ready yet. So if I can look back there and see I can tell the tower we need a couple more minutes. And when you are ready, just stick your head in and let us know that you're ready."

"Okay, great." replied the A once again.

"Is there anything that we all up front could do to make it easier for you? Anything that you guys like in particular?" asked Al.

The A Flight Attendant looked around the table and then said, "I think you've covered everything, right guys?"

"Okay then, we'll see you down at the gate." said Al. Even with that announcement, there was no great movement among the crew. Al sat and chatted casually with the flight attendants as the flight engineer passed by saying that he was going to go down and make sure they put on a little extra fuel for the long ride down to Miami.

It was now 06 J in the morning. In less than one hour,

a crew had come together under the direction of a legitimate authority figure, the captain, and had formed their initial impressions of how they would work with this leader and with each other as a crew to carry as many as 185 people at a time into the air in a Boeing 727. Almost all of the interactions had been between the captain and the flight attendants with the First Officer and the Flight Engineer mainly observing the captain's behavior. Yet even here, the other two cockpit members were learning some things about how this captain would work--and how they might work with him. Still, a crew that had never worked together before would now execute their primary crew tasks without any time for "practice" and would have to perform effectively in a complex system for the next three days.

By 0635 the captain and first officer were in their seats. Preparation for the first flight of the day in any aircraft always takes the longest time. As on any flight, the crew must make their normal preparations which include checking the flight plan, obtaining the departure, enroute and destination weather, verifying fuel requirements, calculating weight and balance parameters, cross checking communication and navigation equipment, monitoring system performance on engine run-up and arranging for clearance from Air Traffic Control (ATC). Additionally, on their first trip in any given aircraft, they must review the aircraft log which contains a record of maintenance performed and a listing of any open maintenance items.

These open items, in conjunction with the Minimum Equipment Listing (M.E.L), define the equipment limitations which might either preclude a flight or limit the performance parameters of the aircraft. On this particular aircraft, the log indicated that one of the oil pressure gauges had been fluctuating on the previous inbound flight but maintenance had replaced the gauge overnight. Al told the FE to keep an eye on it in case it was the sensor and not the gauge.

Tasks during this busy period are divided among the three crew members. Al fills in the flight log, handles any unusual situations that occur and directs the other crew members so that cockpit preparations are made in a timely manner prior to "push" (that time when the parking brakes are released and the aircraft is pushed back from the gate by the tug. Push is also the event which both starts the crew's "block time" and determines whether the flight was started on time.) Additionally, the captain must prepare his side of the cockpit (the left seat) for flight as well as testing all emergency warning devices. Both now and for the duration of the flight, Al is in full command of the aircraft and crew.

The First Officer (FO) must also prepare his side of the cockpit (the right seat) since he will fly the airplane on every other portion of the trip. Dave obtains the clearance from ATC and performs the calculations necessary to determine whether the aircraft's weight is under the

limits (including fuel, baggage and passengers) and whether that weight is correctly distributed in relation to the aircraft's center of gravity. These calculations are also critical for determining the appropriate elevator trim (or adjustment) for takeoff.

The aircraft systems are the responsibility of the Flight Engineer (FE). Although Jim, like many other FEs is a certified commercial pilot, he does not actually fly the plane. Rather, he sits "sideways" in the cockpit facing a panel which allows him to monitor and control the various subsystems aboard the aircraft, including hydraulics, electricals, fuel, engines, and environmentalals (cabin pressure and temperature). Jim's preflight duties include a visual check of the entire outside of the aircraft (the "walk around") and a physical test of the remainder of the systems. He also serves as a backup in rechecking many of the settings and calculations made by the other two crew members. At Al's discretion (or on some occasions, Dave's, should the FO be the "pilot flying") Jim reads and ensures compliance with the various checklists.

After the flight deck was prepared, Al turned to Jim and, for the first time, directly addressed the cockpit crew. He spent several minutes describing how he would prefer the three of them should work as a crew. He emphasized the importance of everyone paying attention to all the communications and speaking up any time there was a perceived discrepancy.

With only a moderate passenger load, everyone was boarded and ready on time and Al called for the push as scheduled. As the tug pushed the plane back from the gate, the FO and FE started the engines. When they were turned toward the taxiway and well back from the gate, Al set the parking brake and told the ground crew they could disconnect the tow bar from the nose gear. When the tug was disengaged from the strut and the ground interphone was disconnected from the aircraft, Al took the salute from the crew chief indicating that all ground crew were clear of the aircraft and it was ready for taxi. Dave received the taxi instructions from the Ground Controller in the tower and Al steered out of the gate area to the outer taxiway and on toward the departure end of the runway. Jim radioed the push time and the final passenger count back to the company's operations office. Al and Dave had agreed on an alternating schedule for "pilot flying" and Al was to fly the first leg. During the taxi he gave the takeoff briefing including both the required items (V speeds or velocities for various portions of the takeoff, and the departure clearance) and other items which he felt to be important in the event of an emergency (in this case, procedures for runway aborts and engine loss after rotation). Because of the long first flight to Miami, they were heavy with fuel so Al gave Jim the authority to automatically dump fuel if they lost an engine after V_1 (the speed at which the pilot would rotate the aircraft's nose upward and begin flying.)

There were no holds for departure and no traffic ahead of them so the tower cleared them directly onto the runway for takeoff. Al notified the cabin crew while Jim completed the takeoff checklist. As Al swung the nose of the 727 well past the centerline and then brought it back so the two main landing gear trucks centered, he slowly pushed the throttles forward and then turned them over to Dave. Jim called out the appropriate lights from his panel while Dave watched the triple gauges in the center of the instrument panel which monitored such engine functions as exhaust pressure ratios (EPRs), fuel flows, and percent revolutions per minute in various compressor stages. The tiered rows of gauges rotated clockwise together indicating all three of the rear mounted engines were performing appropriately. "You've got three good ones" was his only comment as the speed picked up rapidly. The gusting winds were directly in line with the nose of the aircraft and, sooner than usual down the runway, Dave called "V₁, Rotate." Al eased back on the control yoke and the nose immediately responded, followed shortly by a soft thud as the struts bottomed out when the main gear left the ground. "Positive rate, gear up" called Al as Dave pulled the wheel-shaped knob back and all the way to the top of its travel. They were on the way and Jim recorded the time off. Less than a thousand feet above ground level the tower called and instructed them to switch to Departure Control's frequency. Dave checked in with Departure who confirmed radar contact and issued their first heading

change and altitude restriction.

Departure from New York involved the usual number of frequency changes and altitude restrictions. Dave, as the "pilot not flying" handled the communications as they snaked their way up and through the routes dictated by the standard navigational radio beacons. As they cleared 10,000 feet, they were permitted to accelerate beyond 250 knots to their full climb speed. By the time they passed Baltimore, they were on autopilot at their assigned cruise altitude of Flight Level 310 (31,000 ft) for the trip down the coast. The cockpit had settled down to routine.

Perhaps the biggest challenge for the crew at long range cruise is to remain sufficiently attentive. If there is no significant weather either enroute or at the destination and there are no mechanical problems with the aircraft, normal duties are limited to responsibility for their own navigation (according to the filed flight plan) and monitoring the aircraft's performance. The aircraft autopilot holds the altitude and heading constant and keeps the aircraft "trimmed-up" so that it will maintain appropriate pitch as the center of gravity shifts (primarily due to fuel consumption at cruise). ATC monitors their progress along the assigned route and altitude while keeping them advised of any other aircraft in their vicinity. The crew will check-in with each control center as they enter their airspace and they may, from time to time request a more direct routing if conditions permit. Generally, the FE

and at least one of the flying crew members monitors the fuel consumption and time enroute. While there are other responsibilities that must be managed (such as balancing the fuel load and monitoring the temperature in the cabin), there is generally more time than there is work.

Cruise, therefore, is a time when discussions are often held. The topics can and do vary widely, from aeronautical topics to the latest sports contests. It is not uncommon for the crews to discuss how some aspect of the aircraft works, particularly if it is associated with a current MEL. Company policy and management (or perceived lack thereof) is always fair game as are the latest load factors and estimated corporate profits (or anticipated lack thereof). Jokes are often told at cruise. The cockpit is predominantly a white male environment; sexist and ethnic jokes are commonplace. It is often a time, as on this flight, when the crews ask about each other's backgrounds. Because the weather was clear below, on several occasions Al pointed out major cities and geographical points of interest on the public address system for the passengers' benefit. Of particular interest on this route of travel was the huge Vertical Assembly Building at the Kennedy Space Center.

On long cruises, especially when the passenger loads are light, flight attendants may enter the cockpit and talk with the cockpit crew. Because of the limited space, they are always outnumbered when they come in. Even though some general deference to the captain's authority can

occasionally be noted, on the whole, the attendants that come forward seem comfortable talking with and to the cockpit crew. On this flight, the A Flight Attendant came up about an hour into the flight and asked the captain if he would mind making an announcement about 20 minutes before he turned on the Fasten Seat Belt sign so that people could get up and go to the bathroom. She said that otherwise, people would sit through the whole flight and then just as the Fasten Seat Belt sign came on, they would remember that they had not been to the bathroom yet. Then there would be a whole group of them lined up in the aisle just as descent begins. Al thought it was a good idea and said he'd be sure to do that both on the way down and back from Miami. He also thanked her for making the suggestion.

Planning for the descent marks the end of cruise and was initiated by a call from the controlling ATC Center advising that they were cleared to descend to a lower prescribed altitude "at pilot's discretion." This descent clearance also included a crossing restriction, which required Al to make some calculations on his flight plan so that he was at the assigned altitude by the time he crossed a given point along the route. Although he could have descended immediately and met the crossing restriction, experience coupled with a concern for company profits through fuel conservation dictated that it was more efficient to stay as high as he could for as long as he could and still prudently cross the restriction at the

prescribed altitude. In the meantime, Jim had received information about the Miami weather, winds, and runway-in-use over the Automatic Terminal Information Service (ATIS) radio frequency. He annotated this information on the landing card for the pilot flying along with the calculated "go-around EPRs" so the engines could be increased to their maximum safe performance if needed. Dave continued to handle the communications while pulling out his copy of the descent and approach plates which prescribed the normal approach procedures for the Miami landing.

The descent was routine and a visual approach was made. After completing the checklists, Jim moved his seat around and forward in order to monitor the instruments and to help look for other air traffic in the area. On Al's instruction, Dave moved the flap lever through a series of steps, each of which caused the huge trailing edge wing flaps to descend further. The flaps permitted the aircraft to fly at lower speeds with greater lift. About a minute out, Al asked that the landing gear be lowered. Again, Dave pulled a large lever (with a knob shaped like a wheel) out and down. Three red lights signaled the gear in transition accompanied by a noticeable increase in wind roar as the struts and doors moved into the slipstream. The cycling gear noise was followed by the illumination of "three greens" on the instrument panel indicating that the two main gear and the nose gear had locked into position. At 500 feet above the ground, Al insured that their speed was on

target and that the three turbine engines were "spooled-up" so that if additional thrust was required, it would be instantly available. Jim made the last altitude calls as they proceeded through a short final approach and prepared for the landing. Just about three seconds after the fifty-foot call, Al pulled all three throttles back to idle power while raising the nose in a gradual flare that broke their descent and decreased their flying speed. The two main gear settled ever so gently onto the concrete runway while Al held the nose up to bleed off as much speed as possible. Despite the weather conditions in New York, the flight had been smooth and uneventful, as was the landing in Miami. Al's "greaser" brought several "oo's and ah's" from the FO and the FE. His only response was that he "was sure glad his first landing was a squeaker so he wouldn't feel so bad when he bounced the next one in." Al taxied into the designated gate while Dave and Jim shut down the Number Two engine and started the Auxiliary Power Unit which would provide electrical power for the aircraft at the gate. After the parking brake was set and the checklists were completed, Al got up while Dave set-up the cockpit for the next leg back to Baltimore that he would fly. He was a little surprised to find that they would not be held at the gate for clearance back along the busy Jacksonville-Washington corridor.

Al stood at the cockpit door and said goodbye to each passenger as he or she departed, thanking many of them for

flying with the company. As the last woman with two small children left the plane, Al went in to get the latest weather and other paperwork for the flight back. Jim went out for a Miami walk around (which usually took longer than one in Buffalo). The process that was to repeat itself four more times today had finished its first cycle.

The trip back to Baltimore was only slightly shorter than the trip down but no less routine and boring at cruise. Even the winds, which could have offered some degree of diversity, had died down making the descent and landing once again routine. Dave's landing was not as smooth as Al's had been but everyone recognized that he got a "sinker." Sinkers occur when the plane unexpectedly drops before the flare and the only thing the pilot can do is to add power and hope to break the descent before the wheels hit the ground. Dave had recognized it before Al could speak and already had pushed the throttles up as Al said "Sinker." The plane had bounced once, then settled down. Dave brought in the reverse thrust, then braked and ruddered onto the high-speed taxiway before Al took over the taxi. They reviewed the procedures and techniques for sinkers as Al held the taxi while they waited for clearance to cross another active runway.

The next leg was more interesting because it was the short haul up to Boston. No sooner did they get up to cruise then it was time to come down. The intrinsic interest on the flight deck was not shared by the cabin

crews on these legs because they hardly had time to get their beverage carts out before it was time to stow them again. Compounding this was the generally accepted notion among flight attendants that the typical Baltimore to Boston traveller was not a particularly "fun" person. Nonetheless, the trip to New England was equally uneventful marked only by a somewhat unusual series of vectors into Logan because of slower commuter airline traffic.

Another generally accepted belief was that Logan was a good place to be at lunch time since there was a stand nearby that sold seafood sandwiches and clam chowder--and they gave a ten percent discount to airline employees. One of the flight attendants volunteered to bring back orders for the entire crew but because the return flight was equally busy and short, no lunches were eaten until after the New York arrival.

By this time, everyone was tiring and looking forward to the last leg into Charlotte. Again for this leg, the passengers were all in place prior to scheduled push and the departure was normal. Like the Boston leg, the trip out to Charlotte was not particularly long. By 1645, they had arrived at the gate and deplaned all of the passengers. While the flight attendants went inside to complete their paperwork, the flight crew stayed behind to check with the oncoming crew who would take the aircraft on the next leg of the schedule. The only information concerning the aircraft to pass on was about the replaced oil pressure gauge, which

had operated normally.

The oncoming crew had arrived after midnight and spent the night in Charlotte to start their workday in the late afternoon; Al's crew, too, would spend only slightly more than half a day before starting the next day's early flight on an aircraft left at the gate by the after-midnight crew.

After dropping off their flight bags in Operations, the crews from the flight deck and the cabin left the airport together and boarded the waiting motel van for the short trip to their overnight destination. The crew was pre-registered and needed only to sign their names and enter their company ID number to complete the check-in process. The captain formally relinquished authority for the group in saying that the A Flight Attendant was in charge of all social activity for the evening. Apart from arranging a meeting time for the next morning's departure, he abided by that structure. Although he participated equally as a group member and was frequently asked for his opinion during the evening, (and may, in fact, have been accorded more authority than he expected) Al made no decisions for the group. The entire crew (both cockpit and cabin) went to dinner together and then returned to the motel.

At 10 p.m., everyone reconfirmed the time for meeting in the lobby the next morning and then retired for the evening. Fatigue was the word most descriptive of the group. The group's day had started before 0600 and had ended at 2200. They had flown two long legs and three

relatively short legs--and they had been together as a crew for the last 16 hours.

The next two days would find this crew repeating essentially the same sequence of events. The only significant changes would be the destinations of each flight and the length of the duty days. At the end of the three day trip, the group would dissolve with the three flight crew members having little prospect of flying together again in the near future.

Briefly illustrated in this narrative was the typical work performed by a well managed crew on an uneventful day. Members did their work in a context defined by the environment (both meteorologically and organizationally), by the company policies and procedures, and by the explicit role definitions. The next two sections will examine the individual roles, the key organizational influences and constraints impacting the members, and the organizational context in which the flight crews operate.

A Brief Guided Tour of the Aircraft, the Roles and the Norms

The Boeing 727 Aircraft:

Where Design Configures the Crew.

The company in which this research was conducted flies three types of aircraft. The Boeing 737 is the smallest with two engines and a cockpit crew of two (no flight

engineer). The largest aircraft with the longest range is the Boeing 747, a four engine jumbo jet with a crew of three. The intermediate aircraft, both in size and range is the Boeing 727-200 and this was the aircraft selected for this research. With three engines mounted in the rear of the aircraft, it is one of the more widely flown commercial aircraft in use by commercial carriers. And like the 747 it too require a three person cockpit crew. Historically, the three person crew has been the most common size in commercial aviation; according to FAA figures, 60% of the current daily departures in the United States (9,900) are flown by three-person crews. Thus the 727 affords a crew composition with the widest application to commercial aviation today.

Basic Physical Characteristics of the Cockpit

The basic layout of the cockpit can be seen in Figure 2-1. More so than any other single factor, the design and architecture of the cockpit dictates the crew composition and tasks. Note that the rear most crew seat, occupied by the Flight Engineer, is approximately 90 degrees out of line with the direction of aircraft travel when facing the work panel. However, for certain operations such as takeoffs and landings, the Engineer can rotate his or her seat and slide it forward so that it faces forward in a position permitting adjustment of the throttles on the center control station as well as monitoring of the instruments and observation of

traffic in the pattern. Not clear in the picture is the fact that the observer's seat, while located behind the captain's position, is elevated so that the observer can see most of the instruments and has a clear view out the forward windshields.

Insert Figure 2-1 about here

While nowhere as complex as today's modern fighter aircraft control stations, the cockpit of the 727 is sufficiently complicated to amaze the average passenger judging from the reaction of the few who look inside. Figure 2-2 provides but one example of the variety of gauges one might observe on the forward instrument panel of a 727-200 aircraft. It has a rather standard arrangement of "round dial" instruments and dedicated switches rather than the current state-of-the-art cockpits with computer generated displays on cathode ray tubes and multifunction switches.

Insert Figure 2-2 about here

The Roles

The Cockpit Crew

All three cockpit crew members are commercial pilots, yet each one has specific duties and responsibilities, some of which were described in the previous narrative. Some of these duties are specified by regulation while others have evolved from tradition. Still other duties are a function of the design of the aircraft. For example, only the captain can taxi the aircraft because there is only one nose wheel steering device and it is located on the extreme left side of the cockpit where only he or she can reach it. The following sections briefly describe the general responsibilities of the crew members.

The captain. The captain is the pilot in command. Should he or she become incapacitated, the command would shift to the First Officer and subsequently to the Flight Engineer. The captain is in full command of the aircraft and has the final decision in all matters pertaining to proper conduct and safety of the flight. In conjunction with the Dispatcher, the captain is responsible for the preflight planning and dispatch of the flight, including determining the planned and actual fuel load for each leg. Typically, the captain flies half of the legs, the other half being flown by the First Officer. However, the captain has the authority to take control of the aircraft at any time and is required by company policy to make the landing

under certain emergency situations (such as anytime an engine is shut down or an emergency has been declared). He must sign for the aircraft and ensure that all flight times and mechanical irregularities are properly entered in the aircraft's logbook.

The first officer (FO--sometimes referred to as the co-pilot). The FO is literally, the captain's right-hand man. In addition to sharing the flying responsibilities with the captain, he will usually handle the communication duties when the captain is flying (a duty which is also shared by the captain on alternate legs). One of his most important functions is to complete the Weight and Balance Form, which is necessary for assuring proper aircraft performance. Critical are the gross weight at takeoff and its distribution about the center of gravity. Generally, the FO will request and read back the ATC clearance, handle all taxi communications and assist the captain in any other preflight activities or planning.

The flight engineer (FE--sometimes called the Second Officer). Although usually possessing a commercial pilot's license, the FE does not fly the airplane. He is in charge of the aircraft systems such as engines, hydraulics, pneumatics, electrical, fuels, and internal temperature and pressure. His direct control over the cabin environment (as well as the architectural position of his seat) often results in the FE serving as the primary interface between the cockpit and cabin crews. The FE makes a preflight

inspection of the aircraft (the "walk-around") and checks the weight and balance calculations for accuracy. He prepares the data cards required for takeoffs and landings (information on the weather conditions, engine performance data and the critical airspeed settings referred to earlier as V-speeds) and reads the checklists required at various points throughout the flight. The FE maintains the flight log and reports out-times, passenger counts and other data. During takeoffs and landings, the FE moves his seat forward and assists the other two crew members.

The Cabin Crew

A 727-200 cabin crew in the airline where this study was done is comprised of four flight attendants. The FAA considers the primary purpose of the cabin crew to be for passenger safety. They are trained in and responsible for inflight precautions in normal operations and especially for emergencies. These include procedures for emergency landings, cabin depressurization, ditching, and evacuations. Their duties include seating passengers, normal cabin preparations, safety demonstrations and routine safety checks as well as serving food and beverages.

One of the four flight attendants is designated the "lead" flight attendant. That person serves as "the flight attendant in charge" and while there are some standard functions to be performed by that person, the duties can vary at the discretion of the captain.

The Norms

Like most organizational norms, those that guide crew behavior in the cockpit have complex origins. Some have evolved at least in part from the explicit rules prescribed in the Federal Aviation Regulations (FARs). Others have their origins in the evolution of the industry and the development of each crew member. Still others are organizationally specific, and some are defined by the team members themselves. A few of the more commonly observed cockpit traditions are described below.

One of the more complex norms deals with the authority of the captain. It is rooted in history, in the FARs, and perhaps even in the psychological makeup of pilots. The captain is the person who calls for action. The FO might ask if the captain wants to start engines but the captain makes the decisions. Similarly, for some captains, there are certain switches in the cockpit that are strictly within their domain to operate even though they can be reached by either flying officer. These may include the landing lights and the No Smoking and Seat Belt signs.

Another norm which is difficult to trace is the common alternation in flying responsibility between the captain and the FO. While its purpose is to share the flying time, its application varies among crews. Some captains prefer to take the difficult legs (because of predicted adverse weather or known tricky approaches) while others prefer to

merely alternate. The "hub" concept, where flights normally go into and out of the same location in order to maximize loads on connecting flights, has caused some captains to deliberately change the simple alternating pattern because that would result in one of the two pilots always landing at the same airport. But the sharing of flying time is clearly a norm that, when violated, becomes conspicuous. Such violations are often a subject of discussion when describing the peer pressure brought to bear on pilots who had "scabbed" during airline strikes. According to these discussions, some of the ALPA captains refused to allow their non-union first officers any opportunity to fly the airplane.

In this particular company another norm had developed that was apparently somewhat unique among crews in the industry as a whole. In general, both the cabin and flight crews at this company enjoyed a reasonably common social life in the evenings. Partly responsible was the fact that they flew trips together from beginning to end as opposed to some companies which switch cabin and cockpit crew several times a day. Furthermore, these crews were billeted at the same motels on the overnights. And while it was not a consequential behavioral violation to make plans on their own, there seemed to be a level of comfort in expecting the crew to go to dinner together. The process for selecting a restaurant or deciding to go to the hotel exercise room varied across crews but the tendency for the crew to

socialize together was reasonably constant.

The Organizational Context

This research was conducted in an operating airline company performing standard line operations. While the specific impact of the organizational context can not be assessed here¹ it is appropriate to give a general overview of an airline company and the environment in which it operates.

A typical airline company is divided into line and staff functions. This company has an employee stock ownership plan to provide an incentive for employee concern about the overall profitability of the firm. In this sense, each employee is expected to carry some management responsibility. There is still an official management structure that acts on behalf of the directors in implementing the strategies and policies through both the line and staff channels. The staff functions mirror most production oriented companies with specialties in finance, accounting, marketing, personnel and the like. Line operations fall under the direction of the chief operating officer. The line pilots are responsible to a chief pilot while other line functions can be provided in a myriad of ways. For example, maintenance can be provided solely by the company or it can be contracted out. More often than not, it is some combination of these options since it is difficult and unreasonable to maintain complete maintenance

facilities at all destination airports. This practice sometimes leads to the interesting and seemingly incongruent occurrence where outstation maintenance may be provided by the company's most ardent competitor. Some other services are almost uniformly contracted out. Fueling is one example of this type of service.

One special feature of the company where the research was conducted occurred because of a change in the internal organizational structure just prior to the start of data collection. The company had been reorganized into subunits designed to operate reasonably autonomously with their own scheduling and monthly lines to manage. This change was consequential for both the crews and the researcher. Previously, crews were scheduled by a central office. But under the reorganized structure, each small group had to learn how to schedule their own crews. Needless to say, there was a learning curve for everyone involved.

Like all other airlines, the organization did not operate in a vacuum but in a larger extra-organizational context. For example, airline deregulation affected the entire industry and obviously played a part in both line and staff decisions across the board. But such broad external factors are not the focus here and will not be described. Rather, the purpose is to illustrate some of the extra-organizational players that have a direct impact on the crews' daily work.

Most prominent is the Federal Aviation Administration.

While this agency directly influences crew behavior through the writing and enforcement of the Federal Aviation Regulations, it delegates much of the enforcement of standards back to the airline. This is done by certifying qualified pilots within the airline as Check Airmen. These surrogate inspectors examine fellow crew members for compliance with the established regulations and procedures. The FAA also controls the Air Traffic Control network which is responsible for separation and spacing of aircraft. This is perhaps the most direct and ongoing contact each crew has with the FAA on a daily basis. In the course of line operations, the delicate balance between the crew and the controllers is regularly tested and managed. Crews seeking to minimize costs and flight time will request the most direct routing, even if it shortcuts an assigned flight plan. Controllers must jockey aircraft to maintain both vertical and horizontal spacing. While there are no clear rules on how much pressure any one crew can or should exert, the impact of pushing too hard can result in imposed delays for the offending crew. Such sanctions may also be passed on to the other company crews--and so might the consequences of crew cooperation. Likewise, controllers at a major company domicile may give noticeable preference to that company's flights in both departure and arrival patterns and taxi sequencing.

Other agencies also affect line operations, although to a lesser extent. For example, the National Weather Service

provides updates on changing meteorological conditions. Another service is provided by NASA through the Aviation Safety Reporting System (ASRS). In the event of an incident, crews are encouraged to file an anonymous report of the details. Not only can the crew member obtain a once-a-year immunity by submitting such a report, but the industry as a whole can obtain better data on the kinds of problems that occur. NASA feeds back these data in publications distributed to interested parties across the industry.

One last example is the professional interaction across companies between fellow airmen. While there may be overt hostilities between competing airlines, the job of flying the aircraft safely seems to override those differences. Ride reports which describe the type and amount of turbulence at various altitudes are but one example of this type of discourse. Participation in professional meetings for the development of improved cockpit resource management is another.

Summary

The intent of this chapter has been to give the reader unfamiliar with the life of an airline crew some element of background into the forces that impact their work. The narrative of a typical life cycle of a first day of routine line flying provided an expanded view of the crew development and the significant events both outside the

cockpit and behind the locked cockpit door. The second section described some of the constraining characteristics bounding their behavior. Most notably was the architectural confines and design constraints of the cockpit in which they work. A conceptual examination of the roles and norms influencing their behavior likewise was intended to demonstrate that the crews do not enter an open environment over which they exercise absolute control. This notion is expanded by the brief examination of the organizational and extra-organizational environment in which the crews operate. To a large degree, individuals enter a predefined group with predefined roles into which there is limited variance at key points. One of those key points seems to be the early moments of the group's formation and the methodology used to study that critical period is examined next.

Footnotes

- 1 Ongoing NASA research conducted by J. Richard Hackman and this author will attempt to shed light on the question of the organizational impact by assessing crew performance across a variety of flying organizations.

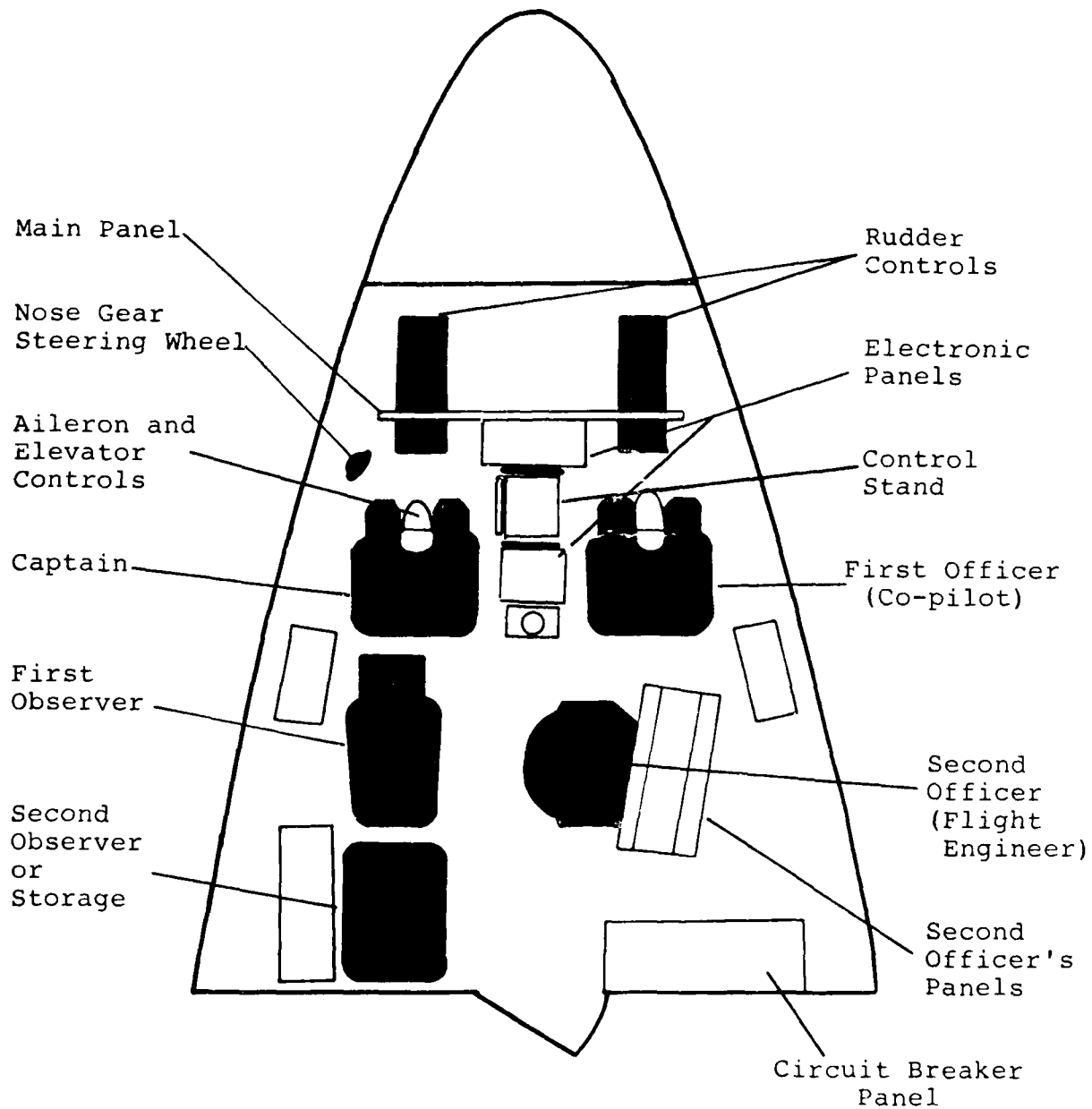


Figure 2-1. Cockpit layout for a Boeing 727-200.

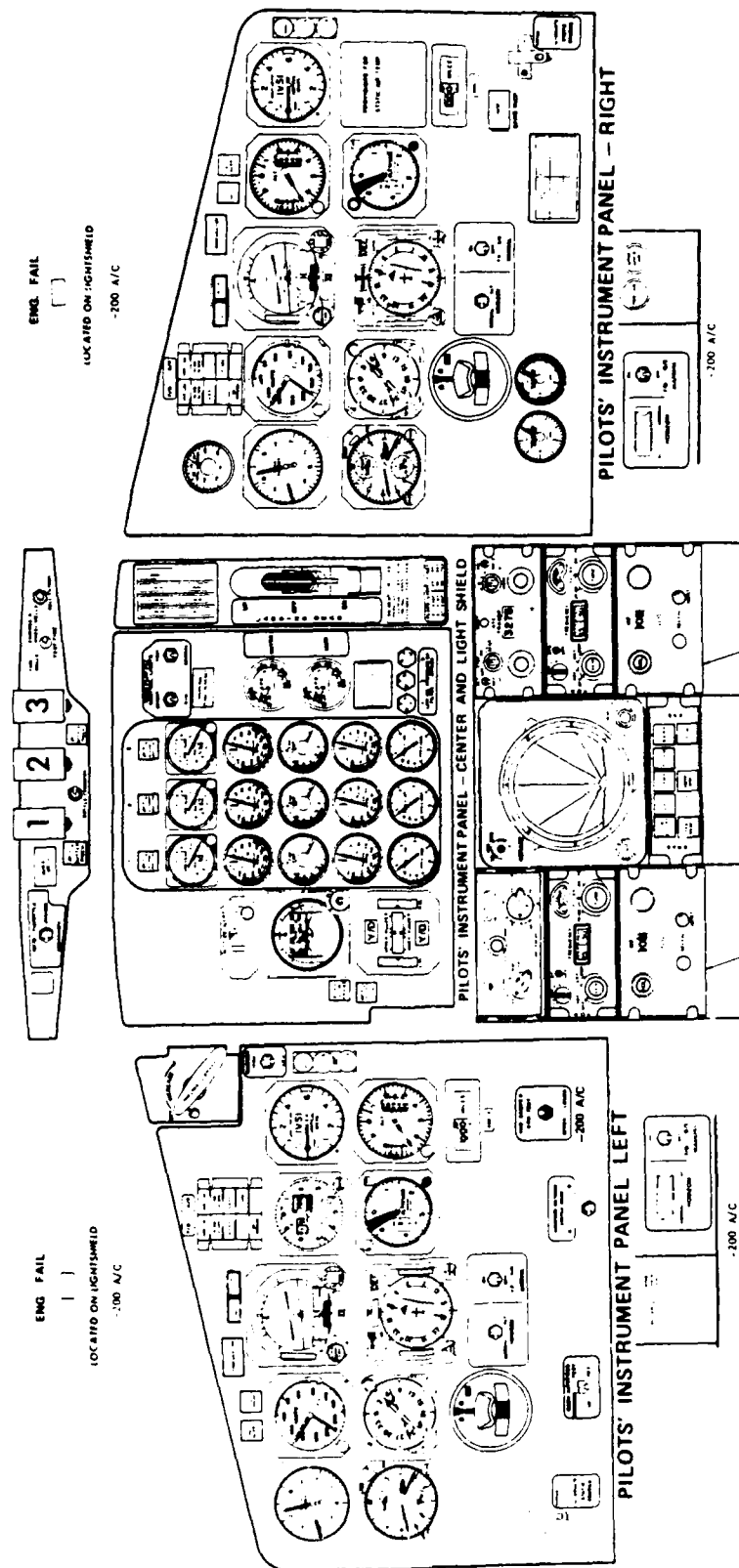


Figure 2-2 Forward instrument panel in a Boeing 727-200.

CHAPTER III: METHODOLOGY

Introduction

This research focuses on the early moments and events in the group formation process of the lives of airline cockpit crews. Recall from the brief introduction to the research strategy presented in Chapter I that the design was to observe the formation processes of crews who were led by captains from the extremes in their ability to develop and manage effective teams. The first task will be to describe the details of that selection process. In conjunction with that description, the demographics of the selected crews will be presented. Then the process of organizational entry and familiarization will be described, followed by accounts of the research arrangements, the details of data collection tools and procedures, and the data analysis strategy. In this chapter's concluding section, several advantages and disadvantages of employing this methodology will be presented as well as an examination of one critical question for the research: subject reactivity.

Selection of Captains to be Observed

Captains who were particularly effective at building and managing their crew as a team and those who were less successful in this regard were selected using a procedure involving nominations and evaluations by other pilots familiar with their cockpit behavior. A check airman involved in LOFT development and crew effectiveness and a

captain responsible for FAA coordination were asked to provide a list of names of captains who were extreme in one or the other direction on the above criteria. They were asked to nominate only those about whom they were personally knowledgeable, and to respond independently of one another. The two evaluators nominated a total of 37 different captains. Not unexpectedly, many names appeared on the lists of both nominators. These two lists were combined and sent to three other check airmen and the newly selected 727 chief pilot along with a letter of instruction (Appendix A). They were asked to evaluate independently the names on the list, selecting twelve captains from each extreme. Their completed evaluations, which were done at their convenience and in privacy, were sealed and mailed to an independent NASA researcher who maintained the confidential data base.

Captains selected for inclusion were those identified by the evaluators as among the most or least effective cockpit leaders. Operationally, this meant that a captain had been selected into his category by at least three of the four raters and that none of the raters had disagreed as to which extreme he should fall. (Even if a captain received three nominations as an effective crew leader, he would not be included in the pool if the other evaluator had nominated him as an ineffective captain in this regard. Of the 37 original submissions, 15 captains were selected as either high or low with "high concurrence."

From the list of fifteen, several were eliminated

because of changes in their organizational status subsequent to nomination. For example, one of the captains was promoted to a position as a managing officer within the company and was eliminated because the new responsibilities would affect his flying schedules for the period of data collection. Of the remaining names, five from each category were selected. Two of these captains were eliminated after the first contact. One was removed because he was transferring from one aircraft type to another; the other chose not to participate in the research.

Although unknown to the researcher at the time because of the research blind (described below) these depletions required a shift in selection strategy. Two options were available: (a) to change the criteria for selection by reducing the amount of concurrence among raters required for entry into the sample pool, or (b) to alter the balanced composition of the pool. The later strategy was selected resulting in a final pool with six effective crew management captains (labeled A captains) and four captains who were less proficient as crew leaders (labeled B captains).

The independent researcher compiled the data and provided this researcher with a list of ten captains from the high concurrence list. To preclude experimenter bias, no group identification was included either at this stage or at any time prior to analysis. I was merely told that I should arrange to fly with each of the ten captains.

The initial plan was for three trips to be scheduled

with each captain. This was reduced to two trips later in the research after a lack of variation across trips was discovered. This became one of the findings of the research, and will be discussed in the next chapter.

Crew Characteristics and Demographics

Observations of crew activity were recorded for the ten captains described above. Since each captain was observed at least twice, data were collected for 20 different crews.

Cockpit Crews

Of the twenty crews, none had worked together as an intact work group prior to the observed flight. Furthermore, within each three person crew, there were three dyads (Captain-FO; Captain-FE; FO-FE), making a total of 60 dyads in the observed groups. Of these 60 dyads, only one (a Captain-FO) had flown together for more than one trip prior to the observed trip. Eight other dyads had flown together once in the past. Fifty-one dyads had never worked together prior to the observed period. The prior joint-work experience data for each of the dyads in the crews observed is presented in Table 3-1.

Insert Table 3-1 about here

There was a diversity in backgrounds in many of the crews. Most crew members had a military background, and many of these individuals continued to fly with the Air National Guard or the Reserve component of their respective services. The remaining individuals had previous experience in corporate, commuter, air carrier, or government flying operations.

The captain was, in all cases, the most senior crew member in terms of time with the company--but he was not necessarily the crew member with the most hours of flying experience. Because of the turmoil in the industry as a result of deregulation and the subsequent collapse of several large carriers, many crew members had joined this company with considerable flight time, and with experience in roles senior to their current assignment. One observed FO, for example, was a retired Air Force Command Pilot.

All crew members except one appeared for work as scheduled, in contrast to the reporting behavior of the flight attendants (described below). The one exception was an FE who was unable to make his flight because he was involved in an auto accident on the way into work. He did call in (from the hospital) to notify the schedulers that he would miss the flight and would require a replacement. Interestingly, the substitute who served as a replacement until a reserve FE could arrive had overheard the conversation of duty schedulers as he walked by and had volunteered to help. He also happened to be from another

organizational unit which, given the fact that most crew members within units didn't even know one another, was not particularly critical. However, this event occurred with an A captain who did take time to note that fact and relate it to the task later in the cockpit briefing.

Flight Attendants

Because the research did not focus on flight attendants, detailed observations of their behavior were not made, but a few general comments are appropriate. In contrast to the cockpit crews, flight attendants work in teams and the majority of them are women. As noted above, while it was not anticipated, neither was it particularly unusual to find one of the regular team flight attendants not reporting as scheduled. On such occasions, a reserve flight attendant filled in. On five of the twenty crews observed, a substitute flight attendant worked at least one leg of the trip. It was noted frequently (both by the researcher and members of the cockpit crews) that there were problems in the cabin whenever there was a substitute flight attendant. Especially on longer trips when one of the four was not a regular team member, there were noticeable difficulties in integrating the substitute. He or she often was seen as not "pitching in to help" and in general tended to become the scapegoat for team difficulties.

Research Arrangements

Organizational Entry

From a methodological standpoint, this research design was intended to operate within the bounds of an ongoing organizational setting so that the intact contextual variety and richness could be included. An equally important practical consideration was that in order to conduct this research, it would have been difficult if not impossible to find qualified aircraft crews in sufficient numbers who were not already part of an intact company. Therefore, both by design and by circumstance it was necessary to enter an organization.

The particular airline in which the research was conducted was selected both because the researcher had access to key decision makers and because the company had already participated in NASA sponsored research projects. The connection with NASA greatly facilitated organizational entry. Not only was the NASA name valuable (because it is the primary agency supporting behavioral research in aeronautics) but the assistance by NASA Ames personnel in contacting airline officials in support of this research greatly aided organizational entry.

The primary connection within the organization was the Chief Pilot (during the course of the research, he was promoted to become an officer of the company). The office most frequented was Operations Coordination. This office

housed the 727 Chief Pilot (separate Chief Pilots for each aircraft type were appointed during the course of the research), who was also included in planning and implementing steps for the research. However, there were no permanent administrative personnel assigned to the Operations Coordination office, which created some vexing problems in managing the study. For example, while merely trying to determine when the monthly roster of trip pairings would be available, I found myself having to explain the entire research scheme and plans to three separate individuals, all in one week. Rather than relying on whoever happened to be in the office on any particular day, it finally was decided to identify one key person and let him handle all aspects of coordination involving the research. That helped considerably.¹

The internal coordinator had an interest in training--in particular, crew effectiveness training. He had noted the differences in how crews worked and, like other check airmen, he could associate that that type of effectiveness with certain captains even though he could not cite specific behaviors. His suggestions for methods which paralleled internal operating procedures aided immeasurably.

Task Familiarization

Anyone who plans to observe the process of a task group needs to be familiar with both the task to be performed and the nature of group process. In many cases, an experienced

process observer can become familiar with the task performed by the observed group in the normal course of the research. This is often because the task is relatively simple or is similar to other tasks which the observer has studied before or has confronted in the literature. Such is usually the case for administrative assignments in a variety of work settings. However, at least three skilled process observers who were not familiar with the specific duties in flying suggested that the tasks performed in an airline cockpit were not amenable to this "pick-it-up as you go" approach. Not only did the cockpit present a physical aura of complexity in its myriad gauges, lights and switches, but the technical argot was often entirely without meaning to the untrained ear. In fact, one of the observers asserted that the task was so mystifying that she found it difficult to even perform the process observations at which she was highly skilled.

The converse is also true. Some observers (e.g., check airmen unfamiliar with group process) who may be intimately familiar with the tasks being performed by a crew may miss entirely the process by which the group goes about its work. They may be so concerned with technical elements that they overlook even gross non-task phenomenon that might affect the group's ability to perform its work. Similarly, subtle verbal and nonverbal communication styles and patterns may go unnoticed by an observer who has not become sensitized to this domain and its impact.

The conclusion, then, is that an observer of the group life of a cockpit crew must possess skills along both dimensions. This is true even if the critical period of group observation occurs before the crew enters the cockpit. For example, if one is to grasp the significance of the captain's briefing statement to the flight attendants that there are, "No MELs but we're currently below mins for the JAX approach," one needs a reasonable degree of sophistication in the cant of the cockpit. That requirement is even more salient after entering the cockpit itself.

Three elements prepared me for this task. First were the qualifications brought to the fieldwork. As an active duty Air Force officer, my prior duties included research on the effects of cockpit complexity on pilot behavior and attitudes. As well as having piloted private airplanes, I had flown and observed aircrew behavior in a variety of fixed and rotary wing military aircraft, both in peacetime and wartime environments. Experience in process observation accrued from my research on work group productivity in a variety of settings ranging from mental health facilities to fire departments. I also served as a work redesign consultant in a wide range of occupational specialties. My doctoral studies prominently included work in group dynamics, leadership, work group effectiveness, and field research methodologies.

Secondly, I spent considerable time familiarizing myself with line flying operations. This phase started with

Line Oriented Flying Training (LOFT) observations in simulator facilities. Approximately forty hours were spent in a variety of functional areas within the organization to better understand the nature of the intergroup issues faced by crews. These functional areas included scheduling, dispatch, fuel administration, maintenance, operations, and training. During the time of these observations, credentials required by the FAA for admission to the flight deck, by the airport authorities for ramp access, and by the company were obtained. Then, eight two-leg orientation flights were taken with an equal number of crews and two overnight trips were taken.

Finally, one full four-day trip was taken with a crew as a pretest. This trip included trials of procedures to be used in subsequent data collection, including tape recordings of crew briefs and critical incidents. In-depth interviews with cockpit crew members were held and periods of time were devoted to observation of the tasks of the flight attendants.

Scheduling

Although the application of the procedures for crew scheduling were extremely tedious and difficult, my intent was quite simply to observe each selected captain and his crew on two different scheduled trips. Additionally, the first trip had to include one scheduled overnight.

Trip One was the most difficult to schedule because of

the number of constraints associated with the overnight. The objective on Trip One was to start with a newly forming crew and follow them from the initial crew briefing through the first day, on an overnight, and back to their home base. Therefore, the first trip needed to meet the following conditions: (1) it must be with a captain on the list; (2) it must be more than a one-day trip (or else there is no overnight); and (3) the first overnight must be at an outstation city (or else the crew does not remain intact-- i.e., they all go to their individual home base "residences" be they houses, apartments, or "crash pads"). Fortunately, most flights departing from an overnight returned directly to the home base. But there usually had to be at least two days between any two scheduled trips because the second day's return to the home base often did not occur until after the next scheduled crew had already briefed.

The second trip for a given captain was much easier to schedule because it only involved the crew formation process and the first leg out and back of flying. In practice, however, scheduling Trip Two was complicated by the same fact that had increased the likelihood that crews had never flown together before--a change in organizational structure involving the creation of separate sub-units. During the Trip One phase, even though these sub-units were in place, scheduling was done from a centralized office called Macro Scheduling. By Trip Two, scheduling was decentralized to each of the sub-units. Not only was each of the units

struggling with the learning process (as was the researcher), but the differences among the sub-units made scheduling across them extremely complicated.

Data Collection Procedures

Preliminary Arrangements

The research required some rather different research methods. On the one hand, since people comprised the fundamental unit of research, it was imperative that they be informed about the research and that they consent to participate. On the other hand, because the critical item of interest was the process of group formation itself, to artificially call the group together before they would have normally formed (i.e., to have a meeting solely for the purpose of obtaining their consent) would have irrevocably altered the otherwise naturally occurring first-meeting phenomenon. Three factors significantly affected the strategy that was devised for obtaining consent. First, the captain was the principal member of the cockpit crew to speak during the briefings--it was the captain's briefing to the crew. Secondly, preliminary familiarization trips indicated that attempting to contact a captain even a day in advance of the flight created some suspicion that had to be dealt with; attempting to contact a first officer or flight engineer in advance to obtain permission was literally unheard of and caused near paranoia. Thirdly, if any member objected to the research when briefed, it would be possible

to immediately terminate data collection and destroy any data collected prior to that time.

The strategy finally devised was to telephone the captain of the crew to be observed as far as possible in advance of the first trip. After introductions, the research was explained in general terms and our interest in crew cockpit functioning was emphasized. NASA's sponsorship of the research was described, as was the cooperative nature of the NASA-company relationship for studies of this kind. Data handling procedures--including confidentiality, anonymity, and absolute protection in accordance with NASA ASRS--procedures were explained in detail. At that point, the captain was asked if he would participate in the research by allowing me to observe the normal course of crew behavior "from the time the crew meets on through the first day and overnight." If the captain approved, I then explained that it was, at times, convenient to use a tape recorder to capture data. It was also explained that before it would be used in the cockpit, the approval of the FO and FE would be obtained. Then the captain was asked if he consented to the use of a tape recorder during the course of the crew observation periods. Finally, after asking if there were any questions that could be answered or any points clarified further, I suggested that I meet the captain 15 minutes prior to show time at a location selected by the captain. This would give the captain a chance to personally meet me and to ask any other questions that might

have occurred to him after the telephone conversation. The second trip was also preceded by a telephone call to the captain. This call was much shorter, asking only if the captain had any questions about the previous period, explaining the differences for the second observation period, and obtaining his approval for the scheduled trip.

Fifteen Minutes Prior to Show

At the prearranged time and location, I met with the captain (in all but one case, which will be described in Chapter IV). I again explained the nature of the observation, emphasizing the focus on normally occurring crew behavior. A detailed script, which was used as the basis for this briefing as well as the subsequent in-cockpit briefing for the other crew members, is included in Appendix B. The captain was again asked if he had any questions and I suggested that the research should be explained to the rest of the crew. I gave no direction as to how this should be accomplished, leaving the method solely to the captain.

After answering the captain's questions, I moved away from him and assumed a position where I could observe the members of the assembling crew.

Show Time

At show time, or in some cases before (as explained later), I would move closer to the group as the captain approached them. The group's "start time" was noted,

triggered by the captain's behavior of no longer addressing a single person (a dyadic conversation) but by addressing the group. This event was usually accompanied by some explicit statement about the task at hand (e.g., "Let's brief"). As the physical boundaries of the group formed, I chose a physical location (relative to the group) similar to the other cockpit crew members. This turned out to be fairly predictable and easy to accomplish, as will be seen in the next chapter.

During the briefing, several items were explicitly noted. Among these were the captain's physical orientation during the briefing; the position of the crew members within the group as they assembled for the briefing and their primary physical orientation; and overall group behaviors (activity level, amount of interaction, distractions, etc.). If asked by the captain, I provided a synopsis of the research for the crew, pointing out in particular the difference between NASA-Yale observation (for research) and FAA cockpit observation (for evaluation). Finally, the "stop time" was noted, again with the operational definition similar to the one used for "start time." These data were committed to paper as soon as possible after the briefing ended.

In the Cockpit

The termination of the crew briefing marked the end of an important step in the group's formation, but it was only

the first step in the formation of the cockpit crew. Other events occurred in the cockpit before the actual job of flying began.

Whereas the primary actor in the crew briefing was always the captain, all cockpit crew members had special roles and tasks in the cockpit. Therefore, before collecting data about the group in the cockpit, it was necessary to obtain explicit permission from the first officer and the flight engineer, and to do so prior to departure. It must also be appreciated that, while having an observer present is a very common experience for crew, this person does not become the focus of crew attention. Members are very busy with normal cockpit preparations, walk-arounds, fueling, weight and balance computations and the like. Similarly, the observer must accomplish some routine preparations for flight himself, such as connecting headsets for ATC and interphone monitoring, checking radio controls and volume levels, and testing oxygen mask flows in normal, 100% and emergency configurations. Additionally, preparations for data collection must be made. In the midst of the activity, usually after cockpit set-up was accomplished but before final fuel and baggage counts arrived, there was an ebb in activity that so I could ask the crew for a few minutes to explain the research.

The research was explained to the first officer and the flight engineer according to the script and in a fashion similar to the explanation given to the captain. It was

made clear to each of them that if they had any objections whatsoever to participating in the research that it would be terminated immediately and any data destroyed. Further, each individual was asked for explicit approval for use of the tape recorder in the cockpit. Included with this request was a guarantee that if, for any reason any one of them wanted the tape after the flight was over, he could have it.

On the first round of observations with each captain, it became apparent that some captains gave in-cockpit briefings to their cockpit crews and some did not. Not to be confused with takeoff briefings (which are required), crew briefings were not required by regulation. On the second round of observations, if the captain gave any form of briefing to his crew, it was tape recorded.

Data collection in the cockpit consisted of two primary techniques. First, task events in time sequence were recorded on a sheet divided into five sections representing the conditions likely to be encountered on any given flight (see Appendix C). The largest portion of the sheet was devoted to normal operations since preliminary observations and the pretest had shown this to be the most common condition. Smaller portions of the sheet were provided for demanding or abnormal conditions in either episodic or continuing durations. Demanding situations required additional crew attention and could be either "episodic" (a landing in reported foggy conditions where visibility would

be near the minimums allowed by regulation) or "continuing" (an instrument malfunction that would require additional monitoring for the duration of the flight). Similarly, abnormal situations could be episodic or continuing, but the severity of the condition was worse. The method used for triggering recording for these events was, "if they had known this was going to happen, they wouldn't have flown." Critical process events were recorded on the back of the sheet in a parallel format (Appendix D). Anytime that critical events were encountered, the tape recorder was activated to capture the verbal exchanges.

The original plan also specified that the tape recorder would be used for time sampling of behavior. The recorder was to be activated five minutes after reaching the top of climb (the highest planned altitude for the course of the flight). This procedure proved to be ineffective because the top of climb was always achieved sometime after reaching cruise airspeed (generally attained as soon as possible after passing through 10,000 feet). As it turned out, the ambient wind roar against the cockpit at cruise airspeed obliterated the tape recorded sound of voices inside the cockpit.

Out of Cockpit

The research also attended to the group social processes in the evening subsequent to deplaning. This included the process of planning for social activities as

well as their execution. Again, critical incidents were noted as well as the general group process with mental notes committed to paper in the evening after the group disbanded.

Summary of Observations Conducted

Behavioral observation time of the crews was 308 hours 40 minutes. The dates and times of observation are specified in Table 3-2. Of particular importance are the times shown under the column heading "Begin" which indicates the time the crew originally formed. These times ranged from an earliest of 0500 to a latest time of 2025. As will be noted later, the time of meeting had little impact on the crew briefing, with a only a few exceptions.

Insert Table 3-2 about here

Of the total crew time, only about one third was devoted to movement of the aircraft. The elapsed time between the moment the aircraft pushes back (out time) until it chocks in (in time) is referred to as "block time." Total block time observed was 133 hours 56 minutes. Average block time per flight was 1 hour 47 minutes with a standard deviation of 43 minutes.

Actual flying time was only somewhat less than this. Flying time is recorded from the time the wheels leave the

runway on takeoff until they again make ground contact as the aircraft lands. Total flight time under observation was 113 hours 31 minutes. The average time for a flight was 1 hour 31 minutes with a standard deviation of 42 minutes. Details of block times and flight times are shown in Table 3-3. Also noted in Table 3-3 in the last two columns are designations representing some measure of the difficulty presented to the crew on the flight. Although of peripheral interest for this specific research (and perhaps open for debate in terms of operational definition as well) they do indicate an interesting and widely reported characteristic. Of the 75 separate flights observed, only sixteen presented demanding performance conditions. Most of these were brief because they only involved adverse weather conditions, although a few were created by minor malfunctions of aircraft systems which demanded increased attention over time. There was only one abnormal period. This was caused when the primary hydraulic system failed in flight due to a ruptured seal on a rudder control actuator. An emergency landing was made without incident. These data, as rough as they are, would seem to lend credence to the old aviation saw that "flying is 99% boredom punctuated by 1% of stark terror."

Insert Table 3-3 about here

Data Analysis

The most detailed data were obtained from the tapes of the crew briefings. Each tape was replayed in its entirety at least five times with specific portions of interest being replayed numerous additional times. Using stopwatches, the tapes were played while the watches measured three different times: the amount of time for the overall briefing, the amount of time that the captain spoke, and the amount of time that others in the crew spoke. Each briefing was also transcribed in its entirety.

Even though the briefings represented the largest and richest amount of data, the numbers were still small enough that the primary method of analysis was qualitative rather than quantitative. A content analysis was performed, coding statements regarding task, boundaries and group norms. It should be noted that the content analysis had to be done line-by-line rather than "by paragraph." Typically, in a report, written account, or a group discussion, major thoughts or themes are grouped into a paragraph. In the crew briefings, the topics changed from sentence to sentence (as will be seen in the results) often requiring separate coding for each line.

After the content coding was completed, the transcriptions were then separated into appropriate categories on the basis of the check airmen's evaluation--

i.e., captains who were either effective or ineffective at crew management. In addition to examining the segregated groups for patterns based upon the three criteria described above, the grouped data were analyzed for patterns in the amount and style of interaction between the captain and the crew, whether there was a logical order of presentation and what the order was based upon, and the method and level for establishment and use of authority by the captain.

Each sketch of the positions occupied by various crew members during the briefing was examined for patterns both as an overall group and within divisions by relative effectiveness. And finally, critical events and general cockpit behavior in normal, demanding, and abnormal conditions as recorded during the flights were examined for patterns of concurrence or deviance with the data from the early moments of the crews' lives.

Methodological Issues

No matter which methodology is chosen for conducting research, there will be advantages and disadvantages associated with it. This section describes several of the more powerful issues that had an impact on this research. The concluding portion addresses the critical issue of reactivity.

Advantage: Organizational Context and Real World Events

This research was conducted with real groups doing real work in a real organizational setting. From both the perspective of the domain within which this research fell and from the recommendations provided by Hackman and Morris (1975), those issues must be viewed as major advantages. In fact, without those advantages, it is difficult even imagining the possibility of any practical results. For this research, observations were of actual airline crews flying line operations--work which would have been done whether the observer was present or not. And as will be suggested later, the organizational context played an important part in the task group's formation process. If the contextual variables are powerful (as the subsequent data suggest) then even simulator studies outside of an organizational framework might fall short. In any case, few simulator studies incorporate "real" flight attendants or includes scenarios where real but unexpected operational problems (such as two misplaced passengers discovered during pushback) occur. These contextual factors and the range of diverse events which occur on the line played a significant part in the development of the crews studied. In controlled research settings, many of these powerful variables might never have emerged and presented themselves for study.

Advantage: Unique Groups Forming Frequently

Given that this research was to be performed in a real organizational setting, finding task groups that met the research criteria (i.e., unique groups, forming frequently with a similar task to perform) could have been a significant problem. In a laboratory, there would have been no problem in forming unique task groups. Such a requirement could have been designed in as a portion of the research plan. However the research would have then lost the organizational benefits described above.

The nature of scheduled work in an airline company turned out to provide the kind of groups necessary. This particular study benefited from the fact that it examined task groups which formed frequently, were for the most part unique (i.e., the members had not worked together before) and who performed a reasonably similar function after each group formation. While airline crews are certainly not the only teams that satisfy these requirements (surgical teams often meet these criteria), they may be one of the better examples. The difficulty is not in finding groups that meet any one of the conditions, but in finding groups that meet all of the conditions. For example, some groups perform similar tasks day after day (a crew of carpenters or a basketball team, for example) but their unique group formation would only occur rarely. On the other hand as noted by Gersick (1985), ad hoc groups form frequently in

organizational settings and their members often comprise a unique set, but their tasks are seldom similar. (In fact, if their task had to be repeated frequently, the organization would most likely form either a standing committee or a production team to handle it.) So airline flight crews would seem to be ideal for the particular research questions at hand. Not only do airline flight crews satisfy the criteria of interest in general, but because this particular organization was reforming into smaller sub-groups, the research enjoyed an even higher likelihood that the members had never worked together prior to the period of observation.

Advantage: Substantial Variation in the Dependent Variable

Because this research was conducted in a reasonably large organization, it was possible to select the extremes of a distribution (even though the distribution was truncated to begin with) and still draw enough subjects to meet the research requirements. The objective was to determine the behavioral differences between effective and ineffective captains at the task of crew management. A random sample would not have, in all likelihood, provided enough participants from the extremes to permit even tentative conclusions to be drawn. Yet the check airmen were able to agree on the sample used even though they had difficulty articulating the specific behaviors associated with their effective or ineffective performances. As will

be seen in the next chapter, for all the captains, there were behaviors in the cockpit that affirmed their classification. But some of the foreshadowing behaviors observed in the briefings were very subtle, especially for several of the less effective captains. Without participation by captains from the extremes, such behaviors might have escaped detection in this initial effort.

Disadvantage: Time Consuming and Researcher Intensive

Working in an organizational setting means working on the organization's schedule. This is particularly true if minimizing the iatrogenic impact of the research itself on the results is important. Therefore, it would have been inappropriate to schedule crews at the researcher's convenience because there may have been a difference in preferred time of scheduling between the very effective and the less effective captains. (In fact, no such difference was discovered.) The research was not, nor should it have been, the raison d'etre for the groups' existence. Therefore, the research had to be scheduled around the naturally occurring task demands. That turned out to be expensive both in terms of overall time (over a year in the organization with four months of intensive data collection) and the amount of direct contact and crew observation time by the researcher (average direct observation time for each captain was 28 hours and 10 minutes).

Disadvantage: Distractions and Small Numbers

This kind of research also is subject to the numerous distraction, perturbations and anomalies that occur in line operations. On the one hand, that is exactly what is desired because the participants must respond in real time to the changing situations. That should (and did) produce powerful effects. At the same time, the researcher must also respond to the same fluctuations, many of which call for considerable flexibility on his or her part. Perhaps even more significantly, line flying provides a range of situations often beyond the imagination of even the most creative designer of experimental scenarios. In this respect, line flying creates situations similar to the scenarios faced by ad hoc task groups--unique problems that need a one-time fix. On line observation results in tremendous breadth but few repeat occurrences of other than routine behaviors.

Disadvantage: The Eldorado Dilemma

Recall that the final sample of ten captains was not an equal distribution of five effective and five less effective captains as originally intended. Part of the explanation for this change was because the list of ineffective captains based upon the original criteria was exhausted. I feel compelled to hypothesize about why this might have occurred and why this phenomenon might be expected to occur regularly

in similar research across a variety of organizational settings.

In an organization which considers any particular characteristic important to its livelihood, those in power should be expected to assign some weight to that characteristic in their selection and training criteria. It is also reasonable to assume that an organization concerned with this characteristic is more apt to be interested in research which might contribute to their knowledge about the phenomenon and thus improve their performance in that regard. Therefore, the requisite permission to conduct the research might presuppose a restricted range on the perceived negative end of the phenomenon to be investigated. In this specific case, a company which is interested enough in cockpit crew performance to permit a researcher organizational entry might also be expected to care enough about that phenomenon to eliminate (either by selection, training or evaluation) those captains which are especially poor at crew leadership. Judging solely from the anecdotal evidence presented by numerous crew members who had worked for other airlines, there was indeed a much wider range of captain behaviors than seen in the present sample. Moreover, the extremes from other organizations that were described were consistently on the "less effective" side.

This suggests a more general dilemma for field researchers. If we presume that organizations control entry to researchers, and that researchers in general have some

cost associated with their presence (be that cost monetary, psychological, or some combination), then it is reasonable to assume that the organization will assess the perceived value of the research in terms of whatever its critical capability is. For example, if an organization sees its critical capability as being able to change production runs quickly to meet urgent client demands, then it might be very interested in research which assesses various communication links between those who take the client orders and those who refit the production lines. To the extent that the research offers some perceived benefit, organizational representatives will be more inclined to permit entry. Now, an organization that cares little about the particular phenomenon of interest to the researcher will, in all likelihood, have taken no steps to affect the manipulation of the variables of interest. That organization might also be expected to exhibit greater variation in the phenomenon, assuming that it is not correlated with some other variable that is selected for or against. Such an organization will also be less inclined to bear the costs associated with the research and thus, be less inclined to permit entry. On the other hand, an organization that is concerned with either the phenomenon or the results of it may see potential benefits from allowing the research to occur, and may be more inclined to allow entry. However, if such an organization is genuinely concerned with the phenomenon, then organizational managers may already have taken steps to

eliminate the end of the continuum that they perceive to be negative.

Hence, the researcher who must rely on organizational entry to study a phenomenon may, more often than not, find him or herself in a position where the range of relevant variables is already restricted. Like Candide, we might find that getting into Eldorado doesn't solve all of our problems. Access does not define the best of all possible worlds.

The Issue of Reactivity

In order to do this kind of research, the observer has to be able to observe the group and hence must be close to the group, be it at the briefing or in the cockpit. Does the presence of the observer affect crew behaviors? Obviously, that is a difficult question to resolve especially within the framework of ethical research involving human subjects. However, both existing literature (Weick, 1968) and data from the current research suggest that the issue of reactivity or interference may not be of great concern here.

In the present research, there were two arenas in which reactivity might have influenced the data. First was the setting for the crew briefing. Recall that the research had been discussed prior to the first meeting with each captain. And although approval had been obtained to observe the group from the time they first met, the bulk of discussion and

background briefings for each captain had been on the larger dimensions of crew work in the cockpit. Each captain also knew that the researcher would be with the crew at least until the second day of the trip for the first observation period. Therefore, there was little reason for a captain to surmise that the focus of the research was on the early minutes of the group's life.

Furthermore, it is not unusual to have many other people around during a briefing--in fact, it is often difficult to hear the briefing because there are so many people around. These other people range from peers (both fellow airmen and flight attendants) to company executives; from newly hired flight engineers to senior check airmen. Therefore, the presence of one additional observer might not add or detract significantly from the proceedings. Similarly (as the next chapter will show) the high concurrence in the data from two overheard but unattended briefings suggest that there was little impact from the researcher's presence. Finally, the introductions by the captains (particularly the A captains) served to integrate the researcher as a member of the group rather than as an outsider.

The second arena was in the cockpit itself. Although one might suspect that adding an observer to the cockpit could significantly impact what happens there, several bits of data (including some points that will be elaborated upon in the following chapter) suggest that the observer's

presence may not be significantly reactive.

a. The Boeing 727 is designed to carry at least one observer and many are designed to carry two observers. No cockpit reconfiguration is made for the observer.

b. It is very common to have an observer (or "jumpseat rider" as they are typically called) present on a flight. Many crew members commute to work from distant locations and ride in the jumpseat. A fourth person in the cockpit turns out to be quite common.

c. Some jumpseat riders are more than observers--they are evaluators. Such is the case for FAA inspectors and Check Airmen. There is clear evidence that the presence of evaluators does affect crew behaviors. The fact that the current research involved only observation of normal line operations and was not any sort of an evaluation was always clarified beforehand and was reemphasized on numerous occasions. Interestingly, on one flight leg, a commuting Check Airman sat in the second jumpseat. Even though he was not conducting an evaluation, the crew's behaviors were noticeably different for that leg than for any other portion when I was there alone as an observer.

d. Beyond the distinction between evaluation and observation was the added guarantee of protected observation. All of the crew members were familiar with the highly credible NASA Aviation Safety Reporting System and its guaranteed confidentiality. The same guarantee was afforded for the data collected in this research.

Similarly, in the course of obtaining FO and FE permission to use the tape recorder in the cockpit the offer was made that "if anything unusual happened and you want the tape for any reason, it is yours." On most of the crews, there was an opportunity to demonstrate the validity of the confidential agreement. It was quite common for crew members to ask a question whose answer, if provided, would have breached the confidentiality guaranteed to another crew. By invoking confidentiality for these questions, the researcher was able to demonstrate the guarantee of protection given to each crew member.

e. Related to the credibility of the protection was the general credibility of the researcher. Some of this credibility was intentionally created by introducing the research as a NASA-supported study and displaying the credentials provided by the company and the FAA. Undoubtedly, the general level of sophistication associated with setting up cockpit equipment and understanding and using appropriate nomenclature or acronyms enhanced the perception of credibility.

f. Supporting the contention of researcher credibility were the comments of crews and captains after having been exposed to the researcher on previous trips. On second flights, the captains (and in some cases, the flight attendants) would frequently make statements in reference to the researcher suggesting that "he was a good guy" or "he's working with us" or "just treat him like one of us." It is

particularly interesting to note that even with that kind of "inside" introduction on the second round, there were still no great differences between the first and second briefings in terms of the captain's overall behavior toward the crew or their general response. Nor was there any particular difference in their cockpit behavior. Therefore, the researcher's presence seemed to be of little significance.

g. In the time frame of the research, numerous other flights were taken in the jumpseat when data were not collected and no information other than company and FAA credentials were provided unless asked for. The behaviors informally observed for these crews generally paralleled those of the crews in the research design.

h. As will be noted in Chapter IV, clear violations of company regulations were observed on occasion. It is difficult to imagine that these would have occurred if reactivity was a highly salient factor.

In summary, there would seem to be sufficient data to conclude that reactivity was not a significant factor in these field observations, either in the briefings or in line operations.

Footnotes

¹ Another incidental but not inconsequential factor was that eventually a person was located who could quite reliably arrange schedules, acquire resources, and complete necessary administrative tasks. That person was a college student working part-time in the Operations Coordination office.

Table 3-1

Number of Times Crew Dyads had Worked Together Prior to the
Observed Flights

	<u>Capt-FO</u>	<u>Capt-FE</u>	<u>FO-FE</u>
1	1	0	0
2	0	0	0
3	0	0	0
4	0	1	0
5	0	0	0
6	0	0	0
7	0	0	0
8	0	0	0
9	0	0	0
10	0	0	0
11	1	0	0
12	1	0	0
13	0	0	0
14	0	0	0
15	1	0	0
16	1	0	0
17	0	0	0
18	3	0	0
19	1	0	1
20	0	0	0

Table 3-2

Dates and Times of Crew Observations

No	Date	Code	Begin	End	Hours	Mins
1	9FEB85	PILOT3	0615	2230	16	15
2	10FEB85	PILOT3	0600	2100	15	00
3	11FEB85	PILOT3	0600	2100	15	00
4	12FEB85	PILOT3	0615	2030	14	15
5	5APR85	A-01-1	0700	2200	15	00
6	6APR85	A-01-1	0500	0940	4	40
7	9APR85	A-09-1	2025	0400	7	35
8	10APR85	A-09-1	1100	1600	5	00
9	12APR85	A-08-1	1500	0200	11	00
10	13APR85	A-08-1	1000	1600	6	00
11	14APR85	A-14-1	0600	2200	16	00
12	15APR85	A-14-1	0600	0930	3	30
13	17APR85	A-17-1	1655	0100	7	55
14	18APR85	A-17-1	1200	1700	5	00
15	20APR85	A-01-2	0700	2130	14	30
16	21APR85	A-01-2	0600	0930	3	30
17	26APR85	A-04-1	0830	2200	13	30
18	27APR85	A-04-1	0700	1015	3	15
19	2MAY85	A-29-1	0505	2130	16	25
20	3MAY85	A-29-1	0545	0830	2	45
21	4MAY85	M-03-1	0615	1400	8	15
22	5MAY85	A-14-1	0600	2200	16	00
23	6MAY85	A-14-1	0600	0900	3	00
24	13MAY85	M-10-1	0500	2130	16	30
25	14MAY85	M-10-1	0530	0815	2	45
26	16MAY85	A-04-1	0645	1800	11	15
27	17MAY85	A-09-1	1400	2215	8	15
28	21MAY85	A-17-1	0540	1305	7	25
29	22MAY85	M-03-1	0600	1330	7	30
30	23MAY85	A-29-1	1230	2030	8	00
31	24MAY85	A-01-2	0600	1230	6	30
32	25MAY85	A-01-1	0515	1000	4	45
33	25MAY85	A-08-1	1530	1940	4	10
34	28MAY85	M-10-1	1300	2115	8	15

Table 3-3

Block (Push to In), Flying (Take-off to Down) Times and
Assessment of Demanding or Abnormal Flight Conditions

No	Flt	Date	Code	Push	T/O	Down	In	Dem	Abn
1	728	9FEB85	PILOT3	0837	0858	0946	0955	Y	N
2	729	9FEB85	PILOT3	1012	1020	1106	1111	N	N
3	735	9FEB85	PILOT3	1500	1506	1548	1553	N	N
4	745	10FEB85	PILOT3	0719	0728	0759	0804	N	N
5	745	10FEB85	PILOT3	0900	0906	1022	1025	N	N
6	747	10FEB85	PILOT3	1125	1132	1320	1325	N	N
7	748	10FEB85	PILOT3	1445	1452	1643	1646	N	N
8	662	11FEB85	PILOT3	0730	0738	0845	0848	N	N
9	663	11FEB85	PILOT3	1345	1359	1647	1650	Y	N
10	663X	11FEB85	PILOT3	1820	1828	2010	2022	Y	N
11	871	12FEB85	PILOT3	0840	0911	1100	1104	Y	N
12	871	12FEB85	PILOT3	1135	1147	1424	1427	N	N
13	872	12FEB85	PILOT3	1722	1730	1935	1940	N	N
14	304	5APR85	A-01-1	0805	0816	0842	0855	Y	N
15	301	5APR85	A-01-1	0940	1000	1047	1054	Y	N
16	301	5APR85	A-01-1	1130	1156	1351	1400	N	N
17	350	6APR85	A-01-1	0725	0735	0916	0926	Y	N
18	225	9APR85	A-09-1	2135	2145	2328	2338	N	N
19	227	10APR85	A-09-1	0049	0103	0322	0327	N	N
20	241	12APR85	A-08-1	1602	1616	1848	1858	Y	N
21	242	12APR85	A-08-1	1942	1954	2210	2219	N	N
22	242	12APR85	A-08-1	2300	2310	2347	2350	N	N
23	256	13APR85	A-08-1	1447	1456	1546	1548	N	N
24	232	14APR85	A-14-1	0700	0711	0752	0758	N	N
25	233	14APR85	A-14-1	0854	0903	0956	1000	N	N
26	233	14APR85	A-14-1	1046	1055	1141	1150	N	N
27	235	14APR85	A-14-1	1225	1232	1323	1328	N	N
28	214	14APR85	A-14-1	1500	1507	1632	1635	N	N
29	308	15APR85	A-14-1	0725	0738	0906	0909	Y	N
30	300	17APR85	A-17-1	1755	1833	2000	2004	N	N
31	293	17APR85	A-17-1	2030	2035	2158	2203	N	N
32	293	17APR85	A-17-1	2238	2240	0030	0048	N	N
33	303	18APR85	A-17-1	1431	1454	1625	1633	N	N
34	304	20APR85	A-01-2	0813	0820	0900	0907	N	N
35	301	20APR85	A-01-2	0949	0956	1044	1048	N	N
36	301	20APR85	A-01-2	1125	1136	1319	1324	N	N
37	350	21APR85	A-01-2	0720	0732	0909	0913	N	N
38	423	26APR85	A-04-1	0950	1001	1113	1117	N	N

(table continues)

Table 3-3 (continued)

No	Flt	Date	Code	Push	T/O	Down	In	Dem	Abn
39	341	26APR85	A-04-1	1139	1146	1337	1341	Y	N
40	346	26APR85	A-04-1	1429	1434	1629	1635	Y	N
41	337	27APR85	A-04-1	0830	0838	0950	0953	N	N
42	312	2MAY85	A-29-1	0605	0615	0847	0850	N	N
43	337	2MAY85	A-29-1	0930	0939	1200	1202	N	N
44	339	2MAY85	A-29-1	1354	1407	1442	1444	N	N
45	227	3MAY85	A-29-1	0702	0716	0804	0807	N	N
46	367	4MAY85	M-03-1	0718	0725	0802	0804	N	N
47	306	4MAY85	M-03-1	0907	0930	1012	1015	Y	N
48	306	4MAY85	M-03-1	1105	1115	1206	1208	N	N
49	307	4MAY85	M-03-1	1234	1240	1324	1328	N	N
50	216	5MAY85	A-14-1	0700	0709	0935	0937	N	N
51	387	5MAY85	A-14-1	1022	1024	1304	1308	N	N
52	387	5MAY85	A-14-1	1438	1445	1542	1546	N	N
53	222	6MAY85	A-14-1	0715	0723	0815	0820	N	N
54	312	13MAY85	M-10-1	0606	0616	0835	0837	N	N
55	337	13MAY85	M-10-1	0930	0939	1210	1213	N	N
56	339	13MAY85	M-10-1	1403	1417	1452	1455	N	N
57	227	14MAY85	M-10-1	0711	0715	0752	0756	Y	N
58	169	16MAY85	A-04-1	0745	0815	0927	0937	N	Y
59	171	16MAY85	A-04-1	1606	1613	1725	1730	Y	N
60	241	17MAY85	A-09-1	1524	1543	1803	1806	N	N
61	321	17MAY85	A-09-1	1930	1934	2145	2153	N	N
62	353	21MAY85	A-17-1	0640	0656	0923	0925	Y	N
63	354	21MAY85	A-17-1	1000	1011	1235	1242	N	N
64	225	22MAY85	M-03-1	0708	0724	0946	0948	N	N
65	236	22MAY85	M-03-1	1046	1058	1309	1312	N	N
66	378	23MAY85	A-29-1	1351	1404	1636	1638	N	N
67	379	23MAY85	A-29-1	1741	1749	2013	2017	N	N
68	279	24MAY85	A-01-2	0714	0738	0938	0944	N	N
69	258	24MAY85	A-01-2	1015	1022	1202	1204	N	N
70	249	25MAY85	A-01-1	0628	0640	0731	0736	Y	N
71	272	25MAY85	A-01-1	0818	0827	0925	0930	N	N
72	346	25MAY85	A-08-1	1630	1643	1730	1733	N	N
73	347	25MAY85	A-08-1	1820	1829	1916	1920	N	N
74	378	28MAY85	M-10-1	1411	1424	1646	1649	N	N
75	379	28MAY85	M-10-1	1812	1825	2043	2050	N	N

CHAPTER IV: RESULTS

Introduction

Recall from the research questions posed in Chapter I that there are three areas of interest for this research. The first is to learn more about the events and processes of group formation for airline crews. Of special interest is the impact of the captain and whether he is behaviorally consistent across time, thus validating the claims of numerous crew members that they can predict a captain's cockpit behavior in the first few minutes of the group's life. A second question dealt with differences between the early behaviors of the A and B captains. If differences are found, do they follow the predictions of the normative model used as the theoretical basis for this research? If so, do effective captains devote more time to matters having to do with the group task, the group boundary and group norms than do less effective captains? Not specifically predicted by the model but of interest given the historical significance and strength of the captain's authority is whether the behavior of the effective captains would impact the traditional expectations inherent in their role. Thirdly (and related to the question of prediction raised earlier), is there consistency between the behaviors of the captains in the early moments of the groups' lives and their subsequent behavior during line operations, both in and out of the cockpit?

Those questions provide a general framework for the

presentation of results in this chapter, with one exception. Following the framework, the first section describes the group formation process and the general role played by the captain in that process. The second section examines the briefing behavior of the A captains. Then, rather than switching to a comparative analysis of the B captains at that point (for reasons that will become apparent), the findings from the line observations for the A captains are presented. Finally, the behaviors of the B captains both in their briefings and on the line are examined.

Early Group Formation

While an event actually occurs in the airline studied called the "Crew Briefing" and the entire crew is usually present for it, its content is not directed toward how the cockpit crew will work; it is directed instead to the cabin crew. On the other hand, the process of the crew briefing seems useful for getting an indication of the captain's, and consequently, the cockpit crew's performance. In many cases, particularly for the A captains, there was a discussion of the tasks, boundaries and norms for cockpit work but that discussion was separate (both temporally and physically) from the "crew briefing." In practice then, there may be two briefings: always one for the cabin crew and sometimes one specifically for the cockpit crew. They are discussed separately below.

The Required Crew Briefing

Chapter 1 of the Company's Flight Operations Policy Manual describes in Section III the "Preparation for Flight Operations." Because of its particular relevance, Paragraph 7 is quoted in its entirety:

7. Crew Briefing

The Captain will conduct a crew brief each day or when there is a crew change. The briefing will normally be conducted in the (organizational subgroup physical location). The briefing should include an introduction of crewmembers, enroute and destination weather, appropriate open logbook write-ups, and other pertinent information (such as whether or not the flight will be operating over water).

In order to standardize crew briefings, the following is considered the STANDARD CREW BRIEF. If there is anything the Captain or crew desires to be conducted differently, it should be discussed at the brief.

- a. The Flight Attendants should pass a verbal passenger count to the cockpit after passengers have boarded and prior to passing up the written count form. The completed count form will be provided to the cockpit as soon as possible after the cabin is ready for pushback.
- b. In the event of an emergency, the cockpit crew will notify the cabin by pressing the cabin call button 4 times (8 chimes will sound in the cabin) or via the PA or interphone. The A (#1) Flight Attendant will proceed to the cockpit in response to 8 chimes. (Section for the B-747 omitted).
- c. If a takeoff is rejected, and there is no need for passenger evacuation, the Flight Attendants will keep the passengers calm and in their seats until the Captain is able to make an announcement. If an evacuation is required the Captain will give the evacuation signal over the PA, interphone or verbally in the cabin.

In a situation where the Flight Attendants must take immediate action in the interest of safety, the Flight Attendants shall attempt to contact the cockpit prior to initiating evacuation. If conditions exist where danger is obvious and imminent, and contact with the cockpit is not possible, the Flight Attendants will signal the cockpit with 4 chimes and initiate evacuation.

- d. In the case of a planned forced or crash landing, the Captain will brief the Flight Attendants on: 1) type of landing, 2) time to impact, 3) brace signal (verbal command "Brace for Impact"), and 4) evacuation signal ("Evacuate" or "Keep your Seats").
- e. After takeoff, the Captain will turn off the No Smoking sign. This is the signal that it is safe for the cabin crew to get up from their stations and make the appropriate announcement. If turbulence is expected or encountered, the Captain may request the Flight Attendants to stay seated after the sign has been turned off and until the turbulence dissipates, at which time the Captain will signal the Flight Attendants.
- f. The Flight Attendants may enter the cockpit any time the aircraft is above 10,000 feet (usually about 10 minutes after takeoff and about 12 minutes prior to landing). They will knock twice and use their key to enter.
- g. The Captain will turn off the Seat Belt Sign at his discretion and make the PA announcement, if appropriate.
- h. Approximately 15-25 minutes prior to landing, the Captain may make an arrival PA announcement. When the Seat Belt sign is turned on, the Flight Attendants will make the appropriate seat belt announcement, if it was not made from the cockpit.
- i. The No Smoking Sign will be turned on 5-7 minutes before landing.... The Flight Attendants will make the appropriate announcements, safety checks and take stations for landing.

Notice that if a captain and crew elect to follow the "standard" procedures, then only the few items in the first

paragraph are required. That would be a very short briefing indeed.

The De Facto Crew Briefings

If one makes the a priori assumption that "the pilots" are "the crew," then the term "crew briefing" is a misnomer. In fact, the crew briefings have practically nothing in their content to do with cockpit crew performance, nor are the briefings directed to the cockpit members. Instead it is an opportunity for the captain to brief the Flight Attendants. Even though the FO and FE are usually present for the briefing, their role is generally limited to being introduced. This places them in the somewhat interesting position of actually being observers of the captain's briefing. This position will be noted later in discussion of proxemics and boundaries. Likewise, the specific briefing content will be addressed later, but at this point it is sufficient to note that all captains met the minimum briefing requirements as outlined above (even though one met the requirement with virtually no excess).

Before proceeding further, it may be useful to present one briefing in its entirety. This briefing is one of the more thorough (but not the longest) and is conducted by an A captain (whose name has been changed in the text). The reader may get a notion of the range of the briefings later in this chapter when the shortest briefing is also presented.

Casual conversation between various members of the assembling crew.

Female: Hi, Will, how are ya?

Captain: Good. Going to Columbus?

Female: No.

Female Flight Attendant: Hi, Will.

Captain: Oh, Hi.

Male: Not sure what happened to Mark.

Captain: See if you can find him, if you will, Hal. (Pause) I don't think I've met you, Will Masters.

Female Flight Attendant: No, you haven't. Hi. Cathy Collins.

Captain: Hi, Cathy.

Female Flight Attendant: Sandy Weaver.

Captain: Sandy is it?

Female Flight Attendant: Yeah.

Captain: Will Masters. Do you know Declan and Ann. This is Bob Ginnett. And Bob's going to be with us this trip. Bob is from NASA so he's going to kind of watch how the cockpit works and just kind of observe. He's uh totally independent uh not with the FAA or (Chuckling) or

RCG: That's the important part. (More chuckling)

Captain: You say it's Cathy?

Female Flight Attendant: Cathy.

Captain: And uh Sandy. (Pause) Is it uh, Ann or Anna?

Female Flight Attendant: Anna.

Captain: Anna. (Pause and light chuckling) (Longer pause). Until the other two guys get here the uh weather in Columbus is nice. The weather in Tallahassee is foggy. But it should clear up uh so it should be a nice..

Female Flight Attendant: About a half hour after

Captain: (Chuckle.) ..it should be a nice day in Columbus. And, uh, out to Columbus, down to Tallahassee, back to Columbus. Have you been to Columbus? (Unintelligible talking.) Didn't see him? (Referring to Mark.)

M: Nowhere obvious.

Captain: We'll go ahead and brief anyway and I'll catch Mark up. My briefs are fairly simple. (Clears throat.) If we concentrate on safety, the passenger, and having fun for ourselves it puts alot of things in perspective in terms of uh what goes wrong. And uh I've flown with Anna and Declan the last trip and (small pause) it was a fun trip. And uh if you have any problems in the back don't hesitate to come up. We'll share all the problems together. I find that uh when things start to go wrong, when we have delays, maintenance type problems, I slow down. I don't tend to bounce off the cockpit, I don't walk around and yell and scream. I try to slow everything down. So if we have some kind of problem, if you have any kind of problem with the ground people or I have a problem, I will have a tendency to get all of us together and handle the person or the problem more as a group. And uh we're not going to rush. If you need more time don't hesitate to tell me. If you have any kind of problem don't hesitate to come right into the cockpit; at any altitude.(Chuckle.) I find it very awkward to talk on the telephone, or communicate through the intercom when we could be talking together. Any questions? (Unintelligible question about the type of airplane.)

Captain: I think it's one of the newly modified airplanes.

Captain: If you have any kind of problems or anything you can - Hi, Mark.

Mark: Hi.

Captain: How are you doing?

Mark: Good.

Captain: Do you know everybody uh here Mark?

Mark: No.

Captain: Cathy and Sandy and Declan and this is Anna. And, uh Bob Ginnett is going with us and uh Bob is from NASA. Do you know Hal?

Mark: Yeah.

Captain: (Pause.) Any questions? (Someone says no.) Conflicts that you've had in the past? (Female chuckling.) (Pause) (Unintelligible conversation and mild chuckle.) I sometimes get off on company philosophy and talking about the frustrations of the company so, if I get too carried away just tell me, hey, Will... Don't hesitate to come up to the cockpit and visit. Bob'll be with us today and tomorrow morning and I'll let uh Bob go ahead and tell you what he's going to do today.

RCG explains the NASA-Yale research (see Appendix E).

Captain: I've got a couple other small points. Little things like the cockpit door and the aft airstairs and all that check with Hal. Maintenance type items. The cockpit door I would like it closed so that the people do not look past you into the cockpit. There's a tendency for passengers to look into the cockpit. I will assume that you are ready to go unless you tell me otherwise. Who's going to be the A today? Declan? Okay. (Female chuckling.) If for some reason you're not ready to go or you have complications let me know and we'll handle it from there. Otherwise I'll assume that you're ready to go, even if it's a short taxi. And you can kind of know the airports that have short taxiways. If you hear the gear go down and the No Smoking sign is not on, on this flight or any other flight, give yourself about 10 seconds to look out the window to see how close we are to the ground and you will probably be close enough that you don't have time to do anything but go sit down. There's a tendency for some captains to get caught up in either unimportant items or very important items, looking out for another aircraft and forget to turn the No Smoke sign on. If that happens and you hear the gear go down you've got about uh 60 seconds. So it's a good indication that it's time to uh head for the seat. (Pause.) Anything else? Any problems? Any problems you've had with uh crews or captains (chuckle) or? I'll plan on meeting everyone at the airplane and uh (short pause) that's it.

Captain sits at the table while the crew discusses a variety of social topics.

The briefing is "normally" conducted in the organizational sub-group facilities as prescribed, but this is not without exception. Two of the briefings were held entirely in the cabin section of the aircraft. The most unusual aspect of these two briefings (apart from their location) is that they both occurred with the same captain on two separate occasions and both cases were precipitated by the same event. On both occasions, at least two of the scheduled Flight Attendants were tardy. After waiting fifteen minutes, the captain decided it was best to go on out to the airplane and brief the crew upon their arrival.

One of the more interesting and somewhat surprising findings was the overall similarity of briefings by captains across time and crews. This was true both for A and B captains. There were two significant exceptions to this finding. One was by a B captain and will be described in detail later in this chapter. The other exception was by an A captain and occurred in response to a rather exceptional situation. Due to increasing load factors from one of the company's serviced cities, a larger 727 aircraft had been substituted for a leg that had previously been serviced by a 737 aircraft. The crew led by this particular A captain was the first to fly the 727 into this expanding market. This change in routing was not known to any of the crew members until the captain checked-in with Dispatch approximately one

half hour before the scheduled crew show time. However, after spending some additional time explaining that change to the crew, the remainder of his briefing was similar to his previous (and in this case, subsequent) briefings. Several examples illustrate this similarity in precise wording across crews.

Briefing 1 (A Captain): My briefs are fairly simple. If we concentrate on safety, the passenger, and having fun for ourselves, it puts a lot of things in perspective in terms of what goes wrong.

Briefing 2: Uh, three things that I concentrate on: safety, taking care of the passengers and having fun for ourselves. I keep it pretty simple.

Briefing 1 (A Captain): And we appreciate the job you do back there. It's a hard job to deal with kids and people everyday and make them feel like human beings but it's probably one of the most important things that we can do to help secure our future. I know you know it's important.

Briefing 2: A lot of the time with 185 people, it's hard to treat each one of them like a human being but we sure appreciate the effort that you put forth in that respect and we don't take it for granted. That's important. We appreciate it.

Briefing 1 (B Captain): If you get too much garbage, don't put it in the forward lav. Double bag it and we'll take it up front. Be sure it's double bagged though.

Briefing 2 : Uh, if garbage is a problem, double bag it and we'll take it up front. Uh, but make sure you double bag it.

Quantitative analysis of the amount of time devoted to the crew briefing also substantiated the captains' similarity across crews. The trend can be noted in the plot of time for the first briefing against time for the second

briefing (see Figure 4-1), and also in the correlation between the two ($r=.73$).

Insert Figure 4-1 about here

Another event, which originally occurred quite by chance, contributes to the conclusion regarding the similarity of briefings across time. One morning I happened to be seated in the corner of one of the group's facilities behind a series of room dividers while preparing the week's flying schedule. With the announcement of "Okay. Let's get started." from the other side of the dividers, I had an immediate sense of deja vu. The ensuing briefing seemed to be a duplicate of a briefing heard the week earlier with the exception of the omission of the introduction of the researcher as an observer. The voice was immediately recognized and the identity of the captain was confirmed after the briefing ended. This "third" briefing, while not recorded because of the ethical principles involved, very much tracked with the prior two briefings by this captain, who happened to be a B captain. Subsequently, with slightly more intent and design on my part, a similar "third" briefing by an A captain was monitored with the same results. These overheard third briefings not only substantiate further the finding of similarity over time and

crews but also are of importance for the methodological issue of reactivity, which was discussed in the previous chapter.

That the briefings were similar across time does not mean that they were "lockstep." This is especially true for the A captains who often made the briefing more personally engaging and situationally specific by noting conditions unique to the particular legs to be flown or unusual conditions surrounding the flights. For a briefing prior to a trip with a flight to a Florida city in May, the captain included the following item:

Cockpit door--I don't care whether you want to keep it open or close it for the demos. In the summertime, it's starting to get a little warm, it's like a greenhouse up there so if you wouldn't mind leaving it open as much as you can down in Florida. If you want to close it for the demo, fine.

Another condition that can sometimes occur in night operations is the contrast in lighting between the darkened cockpit and the lighted cabin. Some captains prefer that the forward cabin lights be turned off before the cockpit door is opened. On a trip scheduled to be flown entirely after dark, one A captain personalized the briefing by surfacing that issue.

It doesn't bother me if it's dark in the front and you've got light in the back.

Both the qualitative and, in this case, the quantitative data suggest the same conclusion. A captain has a style of briefing whether he is an A or a B captain. Across crews and across times, that briefing will be

reasonably standard, with the minor exception that A captains tend to personalize the general topics they cover according to the unique events of a particular flight. The impact of that conclusion is that it is neither very efficient nor necessary to collect repeated samples of the same captain. In general, an analysis of the content and style of one briefing is sufficient, because the other will be similar to it.

Results Unique to Groups and Individuals

As will be seen, there are notable differences between the A Captains and the B Captains, and for the most part there are indications early on in the groups life of these difference. However, there is one other finding which will emerge as the data are presented but which should be noted now because of the impact on format for presentation.

While A captains do vary somewhat in what they discuss and how they do it, their first meetings (as a group) are much more similar to each other than are the first meetings of their B counterparts. A quantitative analogy may help to illustrate this problem. If it were possible to report this qualitative data in analysis of variance format, it would suggest that the "between group" variance would emerge but that there would be much more "within group" variance among the B Captains than among the A Captains. Recalling that the number of B Captains was smaller to begin with and that their range was found to be larger, a difficulty in trying

to describe them as a group is created.

Therefore, in an attempt to be as efficient as possible and still to accurately portray the data, the following format will be used: (1) the characteristics of the A group will be presented as a whole with any significant deviations noted; then (2) each of the four B Captains will be described as an individual case study.

One final complication was encountered in the data analysis. The intended effort was, as noted in the previous chapter, to categorize the briefing statements according to categorize the briefing statements according to the model (i.e., statements about task, boundaries, and norms). Some of the statements clearly fit these categories and some clearly did not--none of those statements posed much of a problem for sorting. However, some statements involved overlap between the categories and hence, presented conflicts in coding. Consider the following example of a captain describing the procedures to be used in the unlikely event of a runway abort on takeoff.

If we abort, give us time to do our checklist items and make a P.A. If you're sitting back there and you're not sure about an evacuation, a little uncertain, please check with us first before we evacuate unless it's so glaringly unsafe that you'd know immediately that you need to evacuate once we get stopped, okay.

In these two sentences, the captain is certainly describing some elements of a task that is to be performed (or perhaps, not performed) by the cabin attendants. There is some element of responsibility for monitoring the conditions and

making a decision. But there is also some element of the boundary relationship between the two crew elements and the communications that are needed in managing that boundary. And underlying all these messages is the implicit norm that this crew should be concerned about safety just because the captain has taken the time to mention the rare but critically important and hazardous possibility of passenger evacuation on an aborted takeoff.

Therefore, it is entirely possible that one might argue for multiple or alternative categorizations of a statement. With that understanding let us proceed with the analysis of the briefings.

The A Captains: Briefings

Tasks

All A captains mentioned aspect of task work that was to be accomplished by the flight attendants and one captain commented on the task significance of the routine aspect of the flight attendant's daily work. There was virtually no mention of task work that was done solely by the flight attendants (i.e., checking seat belt compliance, serving beverages, etc.). The flight attendant tasks that were mentioned had some degree of interface with the work of the cockpit crew. Therefore, they are by definition at least partly related to boundary issues. As will be apparent, the task comment usually included the rationale as well as the task direction. The following examples typify these kinds

of comments:

On closing the cabin door:

-- Okay, just check with us before you close the passenger door for the reason that we might be fueling or we have a mechanic on board or something in the back of the airplane, it's always a good idea to double check.

On opening and closing the cockpit door:

-- Uh, let's see, close the (cockpit) door for the demo because we don't want to distract people's attention from what you're doing. It doesn't have to be fully closed, just closed so they're not distracted by what we do but please don't close it until everybody's seated. I use that as a cue. If it's open I'll assume passengers are standing and I won't push off the gate.

Bringing up the aft airstairs (a task which must be performed by someone in the rear of the aircraft but which can not be done while the aircraft is being fueled. Bringing it up during fueling can result in the aircraft tipping up onto its tail.):

-- The aft airstairs, uh just ask the engineer. Assuming we have gas you can go ahead and bring that up.

Frequently, the captain would describe the tasks that the cockpit crew will perform and the possible impact they might have on the flight attendants' work. Again as above, they would usually provide not only the task explanation but also the accompanying rationale. In several cases, the timing of these events and their relevance were also mentioned.

Hearing the landing gear come down:

-- If you hear the gear go down and the No Smoking sign is not on, on this flight or any other flight, give yourself about 10 seconds to look out the window to see how close we are to the ground and you will probably be close enough that you don't have time to do anything but go sit down. There's a tendency for some captains to get caught up in either unimportant items or very important items--looking out for another aircraft--and forget to turn the No Smoke sign on. If that

happens and you hear the gear go down you've got about un 60 seconds. So it's a good indication that it's time to, uh, head for the seat.

The seat belt sign:

-- At 18,000 feet the seatbelt sign will come off. We'll make the announcement up front so you can keep going on and doing your work. Since we're going to Boston it might be full, I don't know, we'll just turn it on and we'll make the announcement also. But on the longer flight I like to turn it on on the descent and you guys make the announcement. The FAA likes you to read it; it keeps you all in the loop. That way you are aware of how far out we are. It'll be about 20 minutes out I'll tell you.

Task autonomy. One important element of the task is the autonomy to perform that task. The A captains delegated autonomy in two ways. First, they were always concerned about who was going to be functioning in the role of the Lead Flight Attendant. The "Lead" plays an important role and much of the briefing was directed toward her or him, both in content and in eye contact. Once again, much of the work of the "Lead" Flight Attendant is important for boundary relationships. The second method was to delegate autonomy to the flight attendants in general. Typical of these kinds of comments are the following:

Autonomy to the "Lead" Flight Attendant:

-- Uh, so Randy and I have flown together and he's going to be A so he'll be making sure about communications to you. He's in charge back there.

-- Pretty much when you're "Lead" on you day, you're in charge back there. You do not need my permission to board; you run the show back there.

-- Vera, whenever you're ready to load today, feel free. If we have a maintenance problem or something like that we'll let you know but

whenever you're ready back there go and tell the Ground to let you start boarding. Uh, and that will be the same way throughout the trip, whoever's going to be A the next couple of days.

-- So if we have any problems or emergencies or evacuations, I'm not going to call all you guys up. I'm gonna call the "Lead" Flight Attendant up and talk to her.

Autonomy to the crew in general:

-- I will assume that you will be ready to go unless you tell me otherwise. If for some reason you're not ready to go or you have complications let me know and we'll handle it from there. Otherwise I'll assume that you're ready to go, even if it's a short taxi.

-- Uh, when we make our takeoff announcement if you're not ready please let us know because I don't want to take off if somebody's standing up. If we don't hear from you I'll assume everything's good.

Task focused idiosyncrasies. The above comments were typical of the group of A captains. Additionally, several task related comments were used by some of the A captains to focus task performance in one way or another. One captain mentioned a recent experience by another carrier to heighten the relevance and salience of his task comments on runway aborts. Note that he also recommended using what might often be thought of as dead time (e.g., Flight Attendants remaining seated during takeoffs) to review emergency procedures.

If we have to abort on the runway, Herb's going to come up on the air and hopefully tell you to keep your seats. If it's more serious than that, we'll try to direct you if we're going to evacuate where we want you to go, i.e., there's a fire on which side of the aircraft. [Company Y] just did that the other day in Chicago, um, had a fire on

takeoff, aborted, pulled off the runway. They evacuated on the taxiway. So you may think about it as one of those things while you're sitting back there.

Cockpit crews and flight attendants alike understand the significance of the cabin attendant's duties in emergency situations. But one captain always took the time to comment on the task significance of the seemingly routine work performed by the flight attendants. Two examples of his comments, presented earlier in the chapter, illustrate his appreciation for those personal considerations provided by the flight attendants to the passengers. Not only did he acknowledge the difficulty of treating each of "185 people like a human being" but he noted that it may well be "one of the most important things that we can do to help secure our future."

Lastly, the earlier presentation of a total briefing by an A captain contained an interesting idiosyncrasy. That captain always started his briefings by redefining and expanding the conception of the task to be performed. Recall his words, "My briefs are fairly simple. If we concentrate on safety, the passenger, and having fun for ourselves it puts a lot of things in perspective in terms of what goes wrong." With that last sentence he has provided a larger framework for defining the tasks to be performed. He has also provided, in the order of presentation, a priority for accomplishing tasks or making decisions. Finally, it is not specific but general, which not only maintains sufficient flexibility for a variety of circumstances but

also fosters individual crew autonomy.

Boundaries

Compared to other groups described in the literature, an airline cockpit crew might seem to be a well bounded group and in some regards, it is. For example, the design and architecture of the cockpit place an upper and lower limit on the cockpit crew size and the regulations stipulate the minimum size of the cabin crew. Because of such restrictions, this research enjoyed one particular advantage: once the task work of flying the plane began, there was absolutely no individual attrition. But even that advantage dwindled as the crew moved away from the primary task and toward activities such as meals and other social behaviors. Sometimes all seven members of the crew ate together and sometimes lesser numbers were involved. One captain never participated at all in the crew's non-flying social life. Another captain dictated it.

So what might have appeared as a well bounded triad actually became a shifting form with multiple boundaries. For example, I had planned to assess boundary issues by counting the times that "we" statements (meaning the cockpit crew) were used as opposed to "they" or "you" statements (meaning the flight attendants). The futility of that strategy quickly became apparent. Sometimes "we" and "you" were used exactly as described above, e.g., "if something happens up front, we'll let you know." However, at other

times, "we" clearly meant "all of us as a crew." For example, "If we have a problem on the ground or something happens, we have a conflict with people or other flight attendants or anybody, come on up and we'll get together and we'll talk about handling the problem together." There were still other cases where it was not nearly so clear as to who the "we" was supposed to be, e.g., "If we evacuate, take them a football field off the nose and that'll be upwind in case there's a fire and then we'll get a head count."

One captain even described the relevant group boundary as the aircraft itself so that everybody inside could potentially have a role to play. In describing the need and importance of letting the cockpit crew know about possible mechanical problems, he included the passengers as sources of information by saying, "And even if a passenger says something's not right with the airplane. When the flap incident happened, which has made the news again, a passenger told the flight attendant that, ah, he saw part of the airplane fall off in flight, which in fact it had. And her answer to him was, 'Yes, the Captain knows about it.' In fact, the captain didn't know about it, as we all know. So, even if a passenger says something, some of them are pretty knowledgeable."

In spite of the preliminary difficulties in analysis, there were some interesting characteristics regarding group boundary issues. These included proxemics, boundary management, and boundary expansion.

Proxemics. The sketches made after each initial group meeting suggested a general pattern followed by the A captains. To understand these patterns it may be helpful to have some idea of the architecture and general milieu within the room in which briefings were held. Although no two rooms are similar in shape, they generally contain several tables surrounded by chairs, two or more desks for the on-duty scheduler and administrator, a sofa and easy chair grouping surrounding a coffee table, a television monitor and VCR, and a moveable partitioned section behind which are several more desks and work areas.

The activity level in these rooms is either very high or very low, paralleling the crew origination patterns. Crews "make-up" two or three times a day: early morning, early afternoon, and, if the sub-group has late night flights, in the late evening. During a crew formation time, the room is a beehive of activity. Crew members are coming and going and captains are briefing crews in whatever amount of territory they have managed to stake out. Some people are trying to arrange schedule changes on the telephones or in person while others are watching the company's video recorded news shows. During these periods, the room's noise level is an incessant din. At others times when crews are not forming, the room is often occupied only by those few personnel on shift.

Most of the time when a crew was to form, the intact work group of flight attendants had already established a

location, either at a table with chairs or around the coffee table on the sofa and chairs. During this early time, the captain and often other cockpit crew members left the room to check on the necessary paperwork and weather conditions. Upon returning, the captain typically located his crew and either sat down with them or stood within the proxemic bounds of their group. The only exception to this general pattern was that on one occasion, an A captain called his crew into a separate room for the briefing when there seemed to be more than the usual noise level in the room due to construction activity.

Supporting the finding that the crew briefing is more for the flight attendants than for the cockpit crew is the physical location selected most frequently by the FO and the FE for the briefing. Most often, they positioned themselves outside of the proxemic boundary formed by the captain and the flight attendants. Figure 4-2 depicts one of the briefings and is typical of the other cockpit crew member positions. They are, in effect, non-participant observers of the captain's behavior in the briefing. So while the briefing is not directed toward them either in content or in physical direction, they do have the opportunity to learn about the captain with whom they will be working.

Insert Figure 4-2 about here

Managing the boundary. Whether the captain considered the flight attendants as an integral part of "the crew as a whole" or not, by the time the aircraft pulled onto the active runway, there was an actual physical boundary between the two groups--the cockpit door. This actual barrier served as a symbol for discussions about the handling of relationships between the two elements of the crew. All of the A captains except one (the captain who briefed on the aircraft) mentioned the cockpit door in their briefings. The fact that it was discussed is more consistent than what was said about its positioning. Consider the range of comments about the cockpit door:

-- Don't close the door until all the passengers are seated.

-- I don't care when you close the cockpit door. If you want to wait until after you've done your demo or checked everybody, whichever is fine with me.

-- Um, the cockpit door, if you wouldn't mind leaving it open. I think we want to crack it for the demos cause it gets awful hot up there this time of year.

-- Little things like the cockpit door. I would like it shut so that the people would not look past you into the cockpit on the demo.

-- The cockpit door; leave it open at about a 45 during your briefing so we don't accept a hurry up onto the runway with you still doing your briefing.

Since the subject of the cockpit door was broached even though the specific comments varied, the acknowledgement of the barrier is the significant element here. Once again

notice that if the A captains do express a preference, they also provide a rationale, as will be discussed later in the section on authority.

A second area regarding the boundary between the cockpit crew and the flight attendants that was consistently mentioned by the A captains was the "open cockpit" or the fact that the flight attendants were welcome to come up to the cockpit during the flight. Examples of these comments are:

-- If you need anything, don't hesitate to come into the cockpit. It's much easier to communicate than if you pick up the headset and try to talk. Anytime you have a problem come right on in.

-- You're always welcome up front. Knock and we'll be glad to let you in or you can use your key.

-- You're welcome up though we don't have an extra jumpseat up there. But you're welcome up to visit anyway during the course of the flight when you may need a break. Feel free.

-- We have an open cockpit and we're happy to see you up in front.

These comments go beyond the acknowledgement of the barrier and suggest that, at least in the captain's eyes, the barrier is permeable.

Some captains even extended the method for routine maintenance of the boundary by assigning role requirements. As noted earlier, all of the A captains were concerned about the person occupying the "Lead" Flight Attendant role. Some captains even elaborated the importance of the "Lead" role as a kind of linking pin to the cockpit. The following two statements show the intended two-way nature of this linking

function:

-- That means you're (the "Lead" Flight Attendant) in charge back there. You guys need to tell her everything--from "I think somebody needs oxygen" to "I think the door's not closed properly." Let the "Lead" Flight Attendant know. A lot of times she'll come up and she doesn't even know the people are on oxygen back there--nobody told her. How do I know if she doesn't know?

-- And I like the "Lead" Flight Attendant to come up to the cockpit so we can see your face to tell you what to do.

Similarly, some captains defined the linking pin function from within the cockpit. This was typically done using the FE. It is the FE whose work station is placed in a physical position between the two flying officers and the cabin crew. Furthermore, when he is in a position to work at his panel, he is turned at least 90 degrees away from the forward direction of the aircraft. This means that he is already at least half-way in a position to talk face to face with whomever enters the cockpit. He is also closest to the cockpit door and the officer most easily capable of picking up the cabin interphone which is located near his left leg. Examples of this FE linking pin role definition are:

-- (Describing an aborted takeoff procedure.)
First thing we're going to do is take care of the airplane and get it stopped and you'll hear the engineer's voice say "Flight attendants, remain seated..."

-- Um, the aft airstairs: as soon as we get gas just ask Herb and he'll let you bring the aft airstairs up.

The FE is also the officer most likely to communicate with one of the other groups with whom the crew must coordinate. With the exception of ATC, it is the FE who

typically calls for maintenance, who calls on the company frequency for data, who calls ATIS for departure and arrival conditions, and who coordinates with the fuel loaders. The FE is the linking pin to other groups, whether that function is explicitly discussed or not.

Boundary expansion. Two conditions provided an opportunity for an expanded boundary to be defined because the crew was larger than normal. One of these conditions was sometimes present while the other was always present for this research. The former condition occurred when an extra flight attendant volunteered to work a flight so that he or she could be assured of getting transportation. One captain felt that such a boundary expansion was significant and included the subject in his briefings by saying, "If we have any extra flight attendants working the flight please make sure that they sign up and tell us so we know they're on board." When an extra flight attendant worked with the other captains, they typically instructed him or her to "be sure you check with the 'A' for any special instructions."

The second condition that created a larger than normal group was always present in the research situation because of my presence as an observer. That provided an opportunity to observe the process by which the captain dealt with the situation. All of the A captains introduced the researcher and mentioned something about the nature of the work. The fact that the captain let the crew know that he was aware of the nature of the research and had even been included in the

planning for it seemed to ease the boundary crossing for the researcher. Examples are:

-- Bob's doing a research project for NASA and he's going to be riding with us today, spending the night with us in Chicago and coming back out tomorrow. It's on cockpit observation research. And he'll be with us two days.

-- This is Bob Ginnett. And Bob's going to be with us this trip. And Bob is from NASA so he's going to kind of watch how the cockpit works and just kind of observe. He's totally independent-- not with the FAA.

-- This is Bob Ginnett, he's from NASA. He's taking part in a research project seeing how basically crews interact along with the airplane systems.

All but one of the A captains provided the researcher the opportunity to talk to the crew about the nature of the research and particularly its protected nature.

Norms

Norms can be communicated in a variety of ways. Certainly the captain can make explicit the standards and expected behaviors of the crew. He can communicate the importance of a subject merely by including it in his briefing, or he can talk explicitly about its importance. He also can communicate normative information through a modeling process. This may include specific descriptions of his own intended behaviors or, more subtly, through his actual behavior in the briefing and at other times in the presence of the crew. For example, a captain may quite subtly transmit the importance of exchanging information as the group goes about its work by merely taking time to

exchange information (two-way communications) in the time allotted for the crew briefing. The norm that "communication is important" is expressed in the series of exchanges including: (1) I need to talk to you; (2) I listen to you; (3) I need you to talk to me; or even (4) I expect you to talk to me. These more subtle cues will be discussed further in a subsequent section.

Explicit statements about performance. The A captains used two methods in making explicit statements about the work to be accomplished. The first was to make a statement about how he tended to work as a captain. The implicit assumption concerning that statement was that the crew should expect his behavior to impact their work. The following quote from the sample briefing provided earlier illustrates this means of conveying a norm:

-- If we get behind or we get rushed I have the tendency to slow down. If you find that we start having the problem of boarding too many people or something, just tell me. We'll slow down and take our time. Uh, we get rushed and we get behind-- that's the potential to have an accident. And when we start trying to press, that's a bad situation.

The other method involves making direct statements about how the group would work. In one situation, a captain deliberately changed a norm that he himself had explicitly made in the crew briefing. In the briefing the captain had clearly stated that he was "an on-time captain," thus setting the norm that the crew should expect to work according to schedules when possible. However, the last leg of the first day was scheduled into Chicago where a winter

storm was causing havoc with air traffic. After a gate hold because of the developing backup, the flight departed only to be put into the first of three stacks (holding patterns) while over Ohio. After being moved to the second stack, the crew calculated the remaining fuel requirements and determined that a diversion to Cincinnati was prudent. Subsequent to refueling as the crew prepared for the continuation into Chicago (which had now gone to single runway operations due to the severity of the snow), the captain turned in his seat and made the following statement:

Alright, we've had a long day and it'll be a lot later before we get in. We're obviously late so there's no point in hurrying. We know there's going to be a backup and the weather's not good. So the important thing now is that we take our time, check each other, and get there safely. Any questions?

There was no single norm that was explicitly communicated by all of the A captains. However, there were three norms that were frequently communicated as important to the effective work of the group. These were the importance of safety, effective communication, and cooperation between crew members. Sufficient examples of the importance of safety have already been provided. One captain particularly stressed effective communication in his briefing:

But still it (communication) is real important. Anything from you think you smell smoke back there to, uh, "I think a piece of the wing came off," we want to know. By the same token if something happens up front, we'll let you know. I need good communication back and forth. Anytime I had a few

emergencies here at this company it's been some kind of communications breakdown. It's real, real important.

Several captains emphasized the importance of working together but in a rather unique way. They did not stress the importance of the flight attendants working with cockpit crew, but rather did it the other way around.

-- (Captain responding to a question by a newly hired FE): Sometimes when you turn the airplane, we'll help them back here as best we can--push the people off, bring them back out. You gotta get ground to bring them out. A lot of times it's very, very slow. Ten minutes will go by before you see the first little old lady walk out. No way can we turn the airplane the way we need to unless we work with them.

-- So if there's anything that we can do to help you out in anyway, let us know...Let us know what you need. Any comments or requests? Or questions?

-- If you've got any problem children that are on board and you don't want them for whatever reason, let us know and we'll back you up and get them off. No problem with doing that at all.

Explicit normative statements such as these are reasonably easy to identify, but perhaps no more powerful than the subtle or implicit norms that are communicated. Such is the nature of the processes that are a part of the authority dynamic.

Authority Dynamics

From the outset of the research, numerous data supported the a priori authority of the captain. Three diverse incidents illustrate the pervasiveness of this phenomenon. The first is from the crews, the second is from

a bulletin board in one of the meeting rooms, and the third is from two passengers.

1. During the preliminary research for this project, the researcher was attempting to telephone each member of a scheduled crew at least a week prior to reporting to discuss the research and obtain their approval in advance. This seemed to work well with the captains but conversations with the FO and FE always seemed awkward and they were reluctant to say anything about consenting to be observed, even though the researcher explained that FAA procedures would be followed. Finally, one FE said, "I don't know why your asking me. Check with the captain--he's the man." Even asking for their personal permission to be observed in advance was so counter to the accepted authority structure that it was unproductive.

2. One of the crew meeting rooms had a sign posted on a bulletin board that was pointed out by an FO while I was interviewing him. The FO, in responding to a question about behavioral norms and expectations of other crew perhaps regarding his behavior, said as he pointed to the sign, "That's all you need to know about flying in a crew." The sign read:

The Two Rules of Flying

Rule 1. The Captain is always right.

Rule 2. See Rule 1.

3. One afternoon two elderly women preboarded the aircraft ahead of the crowd. After climbing the steps, they paused and peered into the cockpit as the crew prepared for the next leg. One of the women said, "You know, there are two jobs I could never do. One is be a surgeon with all that blood and stuff. The other is an airline captain." "Why?" asked her companion. "Oh, I could never remember what all those switches and buttons and things are for," she replied. After a brief pause, her friend said, "Well, he probably doesn't either." The first woman swung her purse, hitting her friend and said sternly as she walked past her into the cabin, "Don't you ever say that."

It would seem that not only is there a mandated and normed authority dynamic but it is supported by a comfortable dependency relationship as well.

The crew, both by requirement and by tradition is predisposed to accept the authority of the captain. And there are certainly emergency conditions which require the unfailing and immediate response to the leader's direction. Yet a review of the literature on accidents in the previous ten years of commercial aviation uncovered no cases where the principal cause (or even a contributing cause) was failure of the crew to respond to the captain's authority. There were, however, numerous accident reports (see Chapter I) where individual crew members did not assume sufficient responsibility for the group's work--e.g., by not speaking up or challenging a faulty decision made by a captain. As noted in Chapter I, there is a need for all members of the crew to actively participate in the work of the group if a high level of team effectiveness is to be obtained. This is not likely to happen if the crew members are overly dependent on the captain.

Herein lies a dilemma for the captain trying to optimize crew effectiveness. On the one hand, he must do "something" which will validate the authority inherent in his role and thus, permit him to lead and direct immediate responses when required. On the other hand he must do "something" to avoid the crew's over-dependency on him that can hamper the team's overall effectiveness. What is the

"something" (or "somethings") the A captains do that enables them to balance this authority and dependency relationship? The data show that the A captains engage in two kinds of behavioral patterns in the crew briefings which contribute to effective group work: they demonstrate their competence while disavowing perfection, and they engage their crews in the briefing itself.

Establishing competence. The captain must be a skilled airman, and the crew has reason to believe this even before they meet him. He is, after all, examined and credentialed by a variety of sources. The crew briefing gives him an opportunity to fulfill these expectations for his fellow flyers. The A captains met these expectations in essentially three ways.

a. Organized briefings. First, their briefings were logical and ordered in some fashion. Some organized their briefings by priorities while others temporally organized theirs according to the normal sequence of the flight. In either case, the briefings were not scattered. This ordering communicates the impression that they have done their homework; they have thought through the flight. It also demonstrates that they are rational and logical as well. This does not mean that their briefings are lock step and rigid, even though there is the previously discussed similarity across crews. They are quite malleable to the idiosyncrasies and events of the particular crew and briefing situation. This will be demonstrated in the next

section. But they do inspire confidence in that they appear to know what they are doing and have direction. One aspect of this is the balance they maintain between allowing comments and participation while not allowing the briefing to diverge from its necessary course. In this next transcription, notice how the captain maintains his task orientation in the briefing despite one flight attendant's apparent attempt to divert it to personal issues.

Captain: Do we have everybody? Is this it? Hi.

Female Flight Attendant 1: I'm depressed.

Captain: Hi depressed, I'm Jack.

Female Flight Attendant 1: Hi Jack.

Captain: Nice to meet you. (Laughter)

Female Flight Attendant: I'm going to be alot of fun on this two day trip. I'm just going to warn you.

Captain: We're going to have a full cockpit. We've got uh, Jim Verden, getting IOE. Gary's going to be our engineer. This is Bob Ginnett, he's from NASA, he's going to be watching us to see if we can qualify for the astronaut program.

Female Flight Attendant 1: I don't want to be an astronaut. (Laughter)

Female Flight Attendant 2: I'll go.

Male Flight Attendant: You're A.

Female Flight Attendant 2: I don't want to be A, but I'll go.

Captain: He's taking part in a research project seeing how basically crews interact along with the airplane systems.

Male Flight Attendant: He can beverage on the second leg.

Captain: (Laugh) Yeah, I guess it's going to be

real light. Have you decided who wants to be A?

Female Flight Attendant 2: I'll be A today.

Captain You're going to be A? Okay. We've got 562, it's a older model. It's already here. It just arrived at the gate from Orlando. Loads are real light it looks like all night...Ah, the weather's beautiful, about 70 degrees...

b. Technical competence. Secondly, it was not uncommon for the captain to use a small amount of flying jargon or technical knowledge in the briefing. These demonstrations of technical competence were usually short-- not intended to baffle the crew with mystique but more to demonstrate comfort with the difficult aspects of flying. For example:

-- Ah, I should try to shoot for right at 7 minutes for a No Smoking sign. If something happens where we're planning on maybe a full instrument approach and they clear us for a visual, it's going to be less than 7 minutes so we'll go ahead and turn it on and call you on the intercom.

-- If you need help with people in the back, UNAMs, wheelchairs, etc., try to let us know as soon as you can because if we get down below 10,000 feet there's not much we can do as we start getting busy setting up our approach and looking for traffic.

One captain briefly mentioned a technical problem due to weather and then, later in the briefing was questioned about it. At that time he provided a more detailed explanation.

Captain: Right now the weather in Greensboro has fog, low ceiling. We are illegal to do the approach at the present time.

Later. Female Flight Attendant: What was the problem with the runways? (Laughter)

Captain: I don't know that I needed to say that but I thought in order to keep you guys informed. Greensboro has two relatively short runways. So, one runway is a little longer which allows you to go to a lower minimum on landing. That runway is closed so the short short runway is the one that's open but they have what's called a VOR approach into that runway. Your minimums are higher going into that runway so we have to uh see if the long runway is open and then the next thing we need to do is find out probably if the weather goes up enough that we can come into the short runway.

Female: Are we going to go ahead and depart and find out anyway?

Captain: We may go ahead and depart if we have enough fuel to go down and hold and come back here. We may go down and go into a holding pattern and wait for the weather to come up very slightly and then zing in if the weather comes up. So I want you to be aware of the variety of things that are going to go on. The other two guys if they've got a---the co-pilot, I told him to make sure that this stuff is right with dispatch and the engineer I said go to the airplane and make sure we've got enough gas. So it's down to the prioritizing time. (Chuckle.)

Another way they use to convey their technical competence, as well as to demonstrate logical thought processes is to provide rationale for their decisions. That point has been illustrated throughout this chapter so one final example should be sufficient.

Female Flight Attendant: Would you like the door open when you taxi?

Captain: Ah, I like it open and I'll tell you why. Because that way if we get a real quick taxi, I can look back and kind of pace ourselves so that we're not pulling on the runway with the tower expecting us to go right away and you guys aren't ready yet. So if I can look back there and see I can tell the tower we need a couple more minutes.

c. Social competence. Not only does the captain exhibit signs of technical competence, but he also

demonstrates that he can work with the group. Elements of that process will be demonstrated in a subsequent section concerning engagement of the crew. One concrete behavior that the A captains all engaged in was to personally handle the introductions of all the crew members, including the researcher. This is not the case for the B captains.

Disavowing perfection. All of the A captains established their competence by exhibiting the above behaviors, but that only provided their crews with evidence that there is reason to be dependent upon the captain--he knows what he is doing so it is alright to rely on him as the leader. Now he must balance this dependency relationship by having the crew members take responsibility for the work of the group as well. This is important if the crew is not to completely rely on him, especially when he is in error. How does he accomplish this?

In preparing for this project, the researcher spent several days in simulators watching crews perform in a variety of tasks that required group work and interaction rather than demanding individual flying skills. One of the instructors commented that the best crew he had ever observed on these team tasks had been captained by an individual who made the following statement in the crew briefing: "I just want you guys to understand that they assign the seats in this airplane based on seniority, not on the basis of competence. So anything you can see or do that will help out, I'd sure appreciate hearing about it."

As simple as that sounds, it seems to underlie the basic behavior that effective captains use in disavowing perfection. They make a statement suggesting that they don't know something about a particular issue even though the information is often quite readily available. They do not contradict the competence that they have established regarding their ability as a captain. Rather, they typically make some comment about their lack of knowledge (although not on a critical task) or about some personal shortcoming. They seem open about dealing with their own vulnerabilities. Examples include:

-- I sometimes get off on company philosophy and talking about the frustrations of the company so, if I get carried away, just tell me "Hey Will."

-- Oh, you're getting the check? Okay. I thought I was getting the check. I didn't know for sure.

-- I don't know whether we change airplanes coming back.

-- The captain probably just forgot to turn on the No Smoking sign.

-- We'll make the seatbelt announcements but if we forget, if you could back us up and make it, all right?

-- Does anybody know which gate we're at?

-- Does anybody know what we do on this line? It says Florida on my thing. Is that just another Jacksonville?

After one briefing, a new first officer was expressing some concern about his initial performance in the right seat. The captain (an A captain) went even further to avoid the authority-dependency problem.

FO: Will I have to buy beer for every oxygen mask

door that opens? (Note: The cabin overhead oxygen mask doors will sometimes pop open in severe turbulence--or on a very rough landing.)

Captain: As long as I don't have to buy it. Make it even. Landings don't get better with time on this airplane. (chuckling) I shook Miami the other night. BOOOOM! (laughter) That's all I got. Uh, I don't know the weather for Chicago yet. It looks pretty..

FO: It's kind of windy.

Captain: Windy.

FO: 15 gusting to 25.

Captain: That'll be your leg. (laughter). Okay, what gate?

As will be seen later, similar methods for balancing the authority-dependency relationships were observed in the A captains' cockpit briefings.

Engaging the crew¹. The A captains became involved with, and included the cabin (and occasionally the cockpit) crews in the process of the briefing and in the social process of group formation. They used two techniques (although the word "technique" is not quite appropriate. Technique implies a trick or deliberate method whereas the behavior of these captains was very appropriate and consistent with other observed patterns in their normal repertoire of behavior.)

a. Time. First, A captains spent more "non-directive" time with the group. It is not the case that the A captains spent significantly more total time in the briefing with the crew ($\bar{M} = 388.83$ sec.) than did their B counterparts ($\bar{M} = 259.87$ sec.), $t=1.90$, $df=18$, N.S. at the 0.05 level. Nor is

it the case that the A captains spent more time ($\bar{M} = 220.66$ sec.) than the B captains ($\bar{M} = 231.12$ sec.) actually talking to the crew, $t=0.20$, $df=18$, N.S. at the 0.05 level. There was, however, a significant difference in the amount of time that other members of the crew talked while the captain was present. The mean time for talking by others for the A captains was 132 seconds/briefing while the mean time for others talking during the B captains briefing was 29 seconds ($t=3.089$, $df=18$, $p < 0.01$). This data is graphically illustrated in Figure 4-3, which shows that for the discrete data points plotted, the distributions are non-overlapping. Both before, during, and after the briefing, the A captains allowed and encouraged conversation by the other crew members, particularly if it was related to the task. They always asked if there were any questions and several of them solicited comments about any behaviors on other crews or with other captains that might be troublesome. All of them participated, if only by their presence in the social development of the group.

Insert Figure 4-3 about here

b. Real-time interactions. The A captains dealt with the situations that could potentially impact the particular crew they were briefing as they learned about them in the

course of interacting with the crew members. Similarly they interacted on a personal level with the other people who were filling the crew roles. They did not present a "canned briefing" nor did they provide a briefing that could just as well have been given to a group of mannequins. They interacted in "the here and now" with the other people with whom they would work. This is related directly to the subtle normative processes mentioned earlier. By dealing in real-time with the people who were filling the roles, they conveyed important normative information about themselves and the value of the individuals who made up this particular group. They often did this with humor but it was not humor to isolate (canned jokes) but rather humorous responses to real-time interactions. Several examples of this have already been presented (e.g., Flight Attendant: "I'm depressed." Captain: "Hi, depressed, I'm Jack."). The following example illustrates that the captain is paying attention to what is happening in the group. It took place after the formal briefing was over as the captain sat and chatted with the crew.

Captain (to Male Flight Attendant): Are you still engaged?

Male: Yeah.

Female: So far. Oh boy.

Captain: Yeah, we got one Flight Attendant who's not gonna be any fun. (Laughter)

Female Flight Attendant to another: Yea, and another whose pregnant. (loud laughter)

Captain: God! Come on over here next to me. Are

you pregnant? (Laughter)

Female: Yep.

More conversation among crew, and laughter.

Captain: My wife must have picked you guys out.
(Loud laughter) One who's pregnant. Another one's
a nun. (Loud laughter). I've had problems with
nuns all my life.

Female: Sorry.

Captain: Except for you.

Captain: A pregnant, married Flight Attendant.
That shouldn't be. (To RCG) Put that in the
report.

More laughter and crew conversation.

Captain to scheduling person passing by: Hey, no
more pregnant Flight Attendants.

More laughter and conversation among crew and
captain.

Another example of personalized attention by an A
captain occurred once when a scheduled flight attendant did
not report on time. He did finally make the flight but
showed up only 10 minutes before scheduled push. In spite
of the time pressure, the captain invited him into the
cockpit (there were still passengers boarding) and the
following conversation ensued:

(Steve, the late flight attendant enters the
cockpit.)

Captain: Okay, Steve. Are you gonna do the whole
trip with us? Is that right?

Steve: Yea. There was a mix-up with two names on
the printout and I thought I was working on the
ground.

Captain: That's okay.

Steve: But at any rate...

Captain: Are you alert? With us? Are you ready to go?

Steve: Yea, I'm here. I'd much rather fly.

Captain: Okay, very good. This is Dave Hapman (greetings), John Baste, (greetings), and Bob Ginnett. Bob is with NASA. He's doing a research project on the airline system. He's not a Fed, he's gonna ride up here so, it's squared away. Real quick. The weather's good here and on the way. Cindy is A. I'm gonna let her brief you. Please work with her, okay. Ah, everything's standard. Big items: if we abort, give us time to do our checks and make a PA. If you're thinking about an evacuation, check with us first, understand. If we have any extra flight attendants work the trip, make sure they say hello. No secrets. Anything happens in the back, let us know when you can. Anything happens up here, we'll let you know. You're always welcome up front. And when John makes the take-off announcement, if you're not ready to go, for any reason, please let us know, cause we don't want to take off with you standing up. Okay. Safety's paramount. That's about it. Do you have anything?

Steve: Nope.

Captain: Okay

Steve: How's the weather in Pittsburgh?

Captain: It's gonna be beautiful.

Steve: Okay.

Captain: Alright.

Not only did the captain essentially repeat his entire briefing for this one crew member, but he took into account the special circumstances surrounding his appearance. Noting that the flight attendant was late due to acknowledged confusion, he asked if he was "alert, with us, ready to go?" These clearly are comments which consider the unique circumstances of this particular individual's

situation.

The data show that the A captains follow the predictions of the normative model in the briefings. These captains, as a group, discuss elements of the task, define and expand the boundary, make explicit the norms for the group's task behavior, and both confirm and moderate the traditional authority position of the captain. Will their subsequent behavior with the group they have helped to form be consistent after they leave the briefing? The next section describes behaviors of the A captains which were observed in the course of line operations.

The A Captains: On the Line In-Cockpit Briefings

All but one of the A captains took some time in the cockpit to talk with their cockpit crew about how they should work as a group. This "cockpit crew brief" is not required by the FAA Regulations nor by company policy, and it is over and above the mandatory "takeoff brief" given by the pilot flying. These cockpit briefings were shorter and less interactive than the crew briefings, apparently for two reasons. First, there was generally less time (time was not set aside for these as was the case for the required crew briefings so these captains had to "make" time for them) and secondly, there were more distractions (radio calls, ATIS, ground communications, maintenance checks and fuel slips, to name but a few). Yet the A captains did take the time to

say something to the crew. The shortest one occurred during a "hurry-up taxi" followed by a clearance for "immediate takeoff." But even in these restricted circumstances, the captain turned to his crew and spoke briefly about a method he liked to see crews use so there was no confusion and everyone was thinking together:

Captain: If anything happens during the course of the day that you don't understand, you don't think it's right, or you think I'm screwing up--bring it to my attention. If you don't think I understand what you're talking about, persevere until we're of one mind.

Most of the in-cockpit briefings were not as hurried as that. In keeping with the presentation format for the mandatory crew briefings, it might be most useful if a typical transcribed cockpit briefing was presented.

Captain: My briefing for part of my, uh, (pause) when I'm flying. If we have some kind of problem I'd like uh Tom (FO) to go ahead and notify ATC and get the weather, those two things. And if you will Jim (FE), I want you to talk to the flight attendants and talk to the company. That takes care of all the miscellaneous stuff and uh that puts me in a position just to physically fly the airplane. If it becomes a more complex problem then we'll go and handle it from there.

I don't draw any lines down the cockpit and if you're flying and I'm talking on the radio and you call for flaps and I don't hear you or you think it's more expeditious then do it yourself. It's uh (radio transmission) you know, just good judgment. Whatever you think we need, Jim, uh you know in terms of fuel or maintenance, don't hesitate to call maintenance yourself. Out times: call 'em as you see em. If they're hustling or whatever and you think that the station is uh trying to do a good job and it's within a couple of minutes or whatever use your own judgment. Fifteen minutes is our CAB time. And it's nice to keep the company as on time as possible from the CAB point of view.

As far as announcements and the seatbelt sign, to me the guy not flying is in a good position to handle the seatbelt sign. I kind of like the guy not flying, and that can be you sometimes, Jim, to go ahead and uh make the announcements. In a normal flow, if one guy starts it that one guy kind of continues it through that leg, so that you tell the people on the ground why we're going to be delayed, then we'd know once we get to altitude and we turn off the seatbelt what we've told them before so that two or three guys are not repeating themselves and we don't sound like we're coming up with alot of phony excuses.

A couple of words I never use. I never tell anybody we're going into fog and I never tell them really that we're going to be very late. If we're going to get in within fifteen minutes I say we're going to be on time. Maybe we'll make up the time and alot of times people aren't looking at their watch exactly.

So, (radio transmission) I think the job is too much fun to make it hard. You know we've got some guys who make the job really hard. And you, Bob, if you see anything that we missed on this then speak up. As far as I'm concerned you're part of the crew and uh you know if you happen to see lights on Hal's panel or lights up here or traffic and you don't think we see 'em, tell us. (Radio transmissions followed by discussion of engine start time.)

The same patterns of task, boundaries, norms and shared authority emerge here as they did in the crew briefing. In discussing tasks, the captain talked about his tasks and the tasks of others only to the extent that there was interdependence. He did not tell the FO how to fly the plane or the FE how to manage his panel. The boundaries were explicitly made permeable for the sake of effectiveness and "good judgment." They were also expanded to include the researcher/observer for the sake of safety and another set of eyes contributing to effectiveness. Norms of crew safety

and effectiveness were both explicitly and implicitly communicated. And authority was clearly to be shared. (With many captains, the manipulation of the toggle switch for the seatbelt sign is strictly their responsibility and not to be shared or even thought about by other crew members, as will be seen with one of the B captains.)

Several idiosyncrasies of the A captains' cockpit briefings are worth noting. One captain always made a point to direct his comments to the FE, the least ranking member of the cockpit crew.

Captain (turning around in his seat and facing the FE): We want you to know that you're an important member of this crew. You probably don't ever get credit for that. But you need to point out anything that we screw up.

FE: Very good.

Undoubtedly, the FO heard these words too, and if the captain wants the least ranking member of the crew to think through the operations and to question him, surely that is expected of the second in command.

The captain who emphasized the importance of communications with the flight attendants continued this emphasis in his cockpit instructions.

Captain: (to FO) Okay, if your running the radio and we get a clearance like "Climb to 5000," the guy who's also flying should give feedback as well, like uh, "Up to 5000." If you say, "Right to 070" I should come back and say "070" so there's "noooo" miscommunication. So come right back, especially on a crossing restriction, you want the guy flying to feedback what they think they heard. Whatever, they want us to feedback because we've been having some busts on altitude restrictions and that's unacceptable and it's something that they really wanted.

Miscommunicating can do that.

(Standard takeoff and departure briefing given by captain.)

Captain: And on departure, if we lose an engine we're gonna climb up to 500 feet today and we'll clean it up, come back in for an ILS 4 Right. Uh guys, if you see anything, holler, you know. Ah, I'll probably do everything standard, you know. If I get away from standard, I'll tell you why I'm doing it. "I'm gonna keep my speed up" or something like that to make a restriction, I'll try to tell you why I'm doing it. If you have any questions what we're doing, either in the air or on the ground. Bruce (FE), if you see anything, crossing restriction, if you see him put in there 18,000 and you think you heard 21, check. Say something.

FE: Sure will.

Captain: When we're flying, we don't need mistakes like that. Speak up. (pause) Any questions?

FO and FE: Nope.

Critical Events in the Cockpit

During subsequent portions of the flights and the crews' after duty-hours social lives, critical events were recorded. Although there were several critical incidents, there were no surprising behaviors by the captains. Their behaviors continued in the same manner exhibited early in the groups' lives. There were four general areas that demonstrated these similarities.

Calmness in unusual circumstances. When situations deteriorated, either over time or instantaneously, the captains remained calm. On one occasion during pushback, the towbar broke and the airplane continued to roll back

while turning in an increasingly tighter arc. Upon noticing this, the captain applied the brakes and assessed the situation with the ramp crew. Both the ramp crew and the FE were observably excited and concerned about the problem. The captain calmly assessed the situation and merely asked the ramp crew to check the nose strut for any possible damage. He then proceed with his instructions to the crew while the ramp crew went to get another tow bar.

In the one inflight emergency observed (loss of the primary hydraulic system), there was only a slight change in the captain's behavior from that which had been observed on routine landings. Because the loss of hydraulic systems occurred near final approach, he became slightly more directive by asking the FE to proceed only with the essential emergency checklist procedures after determining that the aircraft was responding normally to control inputs. Naturally, the landing briefing was expanded to include emergency procedures, but other than that, there was no change in his behavior. At the extreme, one might have suspected a simulator exercise was in progress. More likely, with the exception of the unusual number of glowing warning lights in the cockpit and the crash equipment surrounding the runways, an observer might have thought it was a normal instrument landing.

Talking through mistakes. Following unusual circumstances, whether generated by them personally, by another crew member, or by some external set of

circumstances, the A captains tended to calmly talk through the events for the sake of improved personal or crew performance. In one obvious case of poor ATC coordination, the crew was given approval for an immediate takeoff (due to inbound traffic) when the filed departure heading (which was not a typical departure) would place them in line with departing traffic from a crossing runway. As the 727 rolled into a steep right bank after takeoff, the tower realized the error and began issuing immediate traffic warnings. After the traffic was cleared and a normal cruising altitude had been reached, the captain went back over the circumstances with the crew, discussed possible causes and recommended some different crew procedures that might preclude such conditions in the future.

Another A captain made a rather poor visual approach into an uncongested airport. After flying through the final approach heading twice, increasing his descent rate to the extent that numerous auditory warning alarms sounded, and finally landing long on the runway, he taxied onto the ramp with a somewhat amazed crew. After setting the parking brake and ensuring the checklist was complete, he turned to his crew and said, "Before we get out of here, I'd like to debrief that horrible approach." He then reviewed his behavior, as well as the behavior of the other two crew members. In particular, he discussed his reluctance to initiate a go-around and the crew members' reticence to suggest one in some obviously unusual circumstances. His

discussion was neither chiding nor accusatory; rather it was aimed at improving future crew behavior.

Coaching. The A captains spent considerable time in coaching² their crew members or suggesting to them techniques that they had found useful. They did not often direct behavior although on the few occasions where that seemed appropriate (at least to the observer) they did become more directive. For example, one FO's first flight took him into Chicago's O'Hare International, normally one of the busiest airports in the country but rather quiet for this midnight arrival. The descent went smoothly with the FO flying the plane and the captain providing tips either as the situation demanded or as the FO asked for suggestions. Given visual approach clearance to land on Runway 9 Right, the FO made a gradual left turn toward the beacon and the two brightly lit parallel runways, 9 Left and 9 Right. As he leveled from the turn and asked for increased flaps and gear down, the quality of his approach deteriorated rapidly in that he was obviously not lined up on either of the two runways but was headed directly for the terminal located between them. At that point, the captain directed him to "not worry about anything else right now and to get lined up." The imprecision of the approach apparently was observable even from the ground since immediately after the captain's directive, the tower radioed, "If you want 9 Left we can give it to you." After lining up properly, the FO "ballooned" slightly on the flare which was followed by a

somewhat abrupt drop onto the main gear. Yet the captain took the airplane only after the FO had returned the reverse thrust levers and headed for a high speed taxiway. On the taxi in, the captain then went back to the coaching style in suggesting visual cues that would help eliminate raising the nose too much on the flare.

With some of the A captains, the entire trip was like a flying lesson on one subject or another. But it was seldom directive. Rarely would they say "This is how you should do it." Instead, it was much more common for them to say, "This is something that I've found to help me when I do this."

Out-of-Cockpit Behavior

All of the A captains participated socially in the crews' evening activities which typically amounted to having dinner together. Occasionally members of the crew would exercise or swim together prior to dinner and sometimes go to an evening nightspot together if their flying schedules permitted it. Even though all of the captains participated, there was a clear authority shift for them as well. None of them even attempted to direct the crew's behavior and usually they would not even coordinate the evening. At most, they would sometimes ask if there were any plans for the evening. One captain overtly shifted the authority structure for the evening by saying (in the casual time following the formal crew briefing) that "the Lead flight

attendant is the social director for our overnights."

The A Captains: Summary

There are some consistent behaviors that effective captains use in the crew briefing and later in their line performance. Their in-cockpit briefings followed the same pattern as their crew briefings, discussing tasks, boundaries, norms, and authority. While flying, they remained calm when conditions or situations deteriorated, they talked through mistakes that had been made, and they coached their team members toward improved performance. In the evenings, they participated with their crews in social activities, but they did not "captain" them.

By now, we should have some fairly good idea of what goes on in the crew formation process and how the effective captains go about developing their team--both in the briefing and on the line. Even though there were consistent general patterns for the A captains as a whole, there were also lots of varied techniques and idiosyncratic methods demonstrated by each A captain. There was no lockstep procedure followed by them all. We also have part of the answers to the three questions of interest for this research. Lacking is an understanding of what the less effective captains do in their briefings and on the line. Examining the behavior of the B captains is the focus of the next section.

The B Captains

None of the overall behaviors of the four B captains was like those of the A captains--nor were the B captains like each other. While each of the B captains did exhibit a few similar behaviors (e.g., they all did give some kind of a crew briefing as required), the amount of diversity requires that each be presented in his own right.

Captain Barry

Captain Barry had been a fighter pilot both as a prior active duty officer and, until recently, on the weekends in the National Guard. He also was a one man crew in the 727.

The crew briefing. Some of his patterns were similar to the A captains--for example, the proxemics of the briefing. He approached the group of forming flight attendants and entered their existing proxemic boundary. The two other cockpit crew members remained outside the group. He was ebullient in the group setting; so much so that he would dominate the group's early life rather than participate in it. In that regard it was altogether fitting for him to introduce everyone in the crew. Similarly, his first briefing and his second (as well as his third) were more than merely similar to each other--they were nearly identical. The biggest reason was that he lacked the real-time interaction with those present in the group as the A captains had demonstrated. He was briefing to "roles," not

to the people occupying the roles. The closest he came to personalizing the briefing was to comment that the group of flight attendants present was all female. As long as he was in command of the briefing, he was comfortable. There was neither reason nor opportunity provided for others to speak because he was the captain and was there to demonstrate his prowess. There seemed to be little engagement and the humor he used was of the kind which tended to disengage (i.e., canned jokes and jokes which took their humor at the expense of others).

There were other significant differences between Captain Barry and the A captains. Before the crew briefing even began, it became apparent that this captain typically used more offensive or obscene language than any of the A captains--a fact which he acknowledged. One of the female flight attendants who entered the group where Captain Barry was standing said, "Oh no. It's Dirty Barry," to which he replied that her comment, "must imply an invitation for group sex." He also commented that the group gets extra duty pay for having to fly with him. Even as the briefing started, the same kind of gender biased chauvinism was again evident.

Captain: Who's going to be the "Lead"?

Female Flight Attendant: Pam is.

Captain. You wanna write down the info. I hate to put you to work this early in the morning.
Hum, four girls. How did we luck out?

He also tended to talk about tasks that dealt with boundary

issues but would often denigrate by innuendo flight attendants' training or competence. An element of paternalism was also apparent.

Captain (about runway aborts): ... If we do come to a screeching halt, you'll hear one of two things on the P.A.: keep your seats or evacuate. Uh, just keep you cool, don't reinforce the problem. We'll tell you what to do.

Perhaps the most important crew briefing precursor of his behavior in the cockpit was the specificity with which he told the flight attendants what and how to do their work. Absent were the general goals or norms, and in their place was minutia regarding task work. Clear also was a definite "we vs. you" style.

Captain: ... Signals: once with the chimes-- this means we want to talk to you. Come on up and see what we want. If you use the intercom, a lot of people are still pushing it down all the time. If you push it to talk and release it to listen, it works much better... Uh, two sets of chimes, this means we want you in your seat. It could be cause there's turbulence and I don't have time to talk to you or whatever. So if you hear ding-dong, ding-dong just take your seat and pick up the intercom and find out what I want... Four sets of chimes: serious emergency. When we're sitting there with our masks on you gotta go to the back and get yours on and then you won't be walking around for a while... Check with us before you raise the stairs.

Also absent was any rationale for his directives.

Significant events in the cockpit. The behavioral patterns exhibited at a mild or subtle level in the crew briefing were more pronounced in the cockpit. Captain Barry gave a very detailed takeoff brief again describing specifically the actions for the other crew members to take in the event of an abort. Beyond that he only made one

statement about crew interaction and it was specifically restricted to technical aspects of a final approach.

Captain (at the end of takeoff brief): ... Ah, on the approach, if you see something you don't like, don't be afraid to say anything about airspeed excursion, glide excursion, something like that.

As the trip continued, the behaviors of the captain increasingly contradicted this statement. On numerous occasions he would turn to the engineer's panel and tell him to make a minor correction in cabin temperature or pressure. Once he told the FE to cross feed fuel. The FE replied that he had been watching it and was going to do it soon. Captain Barry told him to do it now and then told him, "When you're cross feeding, turn your checklist over so you don't forget what you're doing." This was very different from the typical "coaching" behavior of the A captains. Here he was not only specifying the tasks to be performed but he was telling them in detail how to perform each task.

Captain Barry enjoyed flying--and demonstrating his flying proficiency. He always initiated the offer of a beer bet for the best landing of the day, and he usually won (according to his own accounts--after all, "that's why I'm the captain"). On his legs, he normally disconnected the autopilot prior to departing the assigned cruise altitude and hand flew the airplane down to landing.

Captain Barry's controlling behaviors were also apparent when the FO was flying. When the FO touched down on landing and pulled the reverse thrust levers, the captain invariably moved his hand over onto the levers in the raised

position, forcing the FO's hand off of them. The captain never permitted the FO to apply the brakes or to rudder off of the runway. On one occasion, toward the end of the day, the FO stated in his descent briefing that he would turn off the active runway onto the highspeed taxiway if it was available. The captain countermanded that statement. On another leg, the captain descended down through 12,000 feet without turning on the seatbelt sign. The FO reached up and placed his finger against the seatbelt toggle switch and asked the captain if he wanted him to get the seatbelt sign. Captain Barry said, "No, not yet," so the FO lowered his hand. Less than 15 seconds later, the captain reached up and turned on the seatbelt sign as the FO looked on. The FO said nothing, then turned and looked out the window for the next two minutes.

Even the researcher/observer was a target of Captain Barry's direction and control. As I prepared for the first flight of the morning by checking the oxygen flow and setting the radio monitors, the captain turned and handed me a set of headphones. I thanked him and explained that I had an earpiece. Captain Barry told me to stow the headphones, so I got up and prepared to put them on one of the hooks on the bulkhead at the back of the cockpit. Captain Barry said, "No, don't put it on that hook, put it on the other one." There seemed to be no difference between the two hooks (except for about one foot in lateral distance) but his behavior certainly caused me to question my own

competence. "Why didn't I know why they shouldn't hang on that hook? They had hung there in other cockpits. What was wrong with that? What was wrong with me? What else would I be corrected on? Did I look stupid? And how much of what I was supposed to be observing had I missed while asking myself these questions?" More importantly, could the same process happen to the other crew members?

Captain Barry's behavior in the evenings was no less controlling. Whereas the A captains relinquished control for social activities, Captain Barry dictated it. As the crew departed the airplane and headed for operations to check out, the captain said, "While you guys check out, I'll go pick up a rental car and meet you back here. It should only be a couple of bucks apiece and that way we can go downtown. I know a great place to go." When there was no groundswell of support, he followed up with, "What's the matter? Don't tell me I've got a bunch of 'slam-clickers' on this crew." ("Slam-clickers" is a derogatory term used to describe crew members who do not socialize after duty hours. They go to their room, slam the door shut, click the lock, and do not come out until the next show time.) At that point, everyone agreed to go along.

Captain Barry took it upon himself, apparently quite naturally, to provide the entertainment while the group waited in the lounge to be seated for dinner. His specialty was telling jokes and he told more than anyone else among the crew. The barrage of jokes continued on through dinner

and by the time the crew finished eating, there seemed to be no gender, ethnic, racial, religious or sexual preference group left unscathed. As the evening progressed, so did his ribald behavior.

If one equates individual technical competence with "The Right Stuff," then Captain Barry had it. If one equates macho behavior and bravado with "The Right Stuff," then Captain Barry fit the mold. But if one seeks a balance of competence with imperfection, and "engagement with" rather than "dominance of" the crew, then Captain Barry fell short.

Captain Brent

In one-on-one conversation, Captain Brent was one of the most relaxed interpersonal captains in the sample. In fact, in my initial telephone conversation with him, he was more than cordial and accommodating. When I told him that I would like to fly with his crew, Captain Brent said, "Sure, anytime. Love to have you." When told that it would help if I explained the nature and procedures for the project, he said that wasn't even necessary. It was as if, by offering him information, there may be something difficult for him to deal with and he preferred to avoid that. Even though he, as the captain, was the only one with the authority to permit the observer to ride, he preferred to avoid that responsibility. Such was the nature of this captain.

The crew briefing. Before the briefing started,

Captain Brent made sure he knew the names of all the flight attendants, but he did not make the introductions, nor did he ensure that the other cockpit crew members knew the flight attendants or vice versa. The presentation of his briefings, although similar in overall content to one another, did not have the order and organization found in other captain's briefs. Because he jumped around from one topic to another, it was difficult to ascertain the pattern that might be driving his thoughts, which in turn, could decrease the aura of technical competence presented by the A captains. He would talk about the weather, then about the seatbelt sign, then more about the weather, then the No Smoking sign, then more about the weather, and so on. In terms of the range of contents covered, the briefing was similar to the A captains, although none of the items were stressed. The norms were especially less than clear because the captain did not stress any particular issue (e.g., communications, cooperation, or safety). The most detailed portion of his briefing, as indicated above, was about the weather.

Although he did mention working together in terms of information flow, the boundary issues were left unclear in his briefings. One aspect of the data about boundaries is noteworthy. All of the A captains introduced the researcher and then briefly mentioned something about the research. This served to bring the researcher within the group boundary and justify his presence. Captain Brent did

introduce the researcher, but either forgot or mispronounced his name on both occasions, differing from the engagement process used by the A captains. And he said nothing about the justification for the research.

First Briefing

Captain: This is Bob, ah, I forgot your last name.

RCG: Ginnett.

Captain: Ginnett. And he's going to tell you why he's on the flight.

Second Briefing (approximately half way through)

Captain: Um, this is Bob Gillette.

RCG: Ginnett

Captain: Ginnett. That's close. He's uh, well, I'll let him explain.

There was another characteristic about the style of his briefing that set it apart from the all of the other captains, even though it was internally consistent with his tendency to avoid difficulties. This characteristic was considerably more subtle than other captains' briefing characteristics and did not become apparent until after repeated playbacks of the audio tapes. This captain tended consistently to disavow and hence negate his own infrequent directive statements. He did this in two related ways.

The first method was accomplished by attaching a "tag" after directive statements. The particular tag, nearly always the same, was a slight laugh or chuckle. The effect of this was to add a disclaimer to the previous statement. In essence, "I've made this statement but, you don't have to

take it too seriously." The second method was was to rephrase normally accepted directive statements from the captain into questions, or to add a phrase or comment after a statement that served as a disclaimer. For example, it was typical for all the A captains to start the briefing--to call the meeting to order. They would usually do this by saying, "let's brief real quick" or simply by starting. This captain would ask a questions rather than make a statement.

-- So, you guys ready to go to Miami and then to Birmingham?

-- Okay, do you guys want to brief?

Consider the following verbal tags added by the captain.

-- They're really short, uh, short-handed out there so any help we can give 'em in Chicago. Enough said about that.

-- The No Smoking sign will come back on again 5 to 7 minutes out. Uh, how are you doing?

-- Especially if something happens to the airplane, too, you know, don't assume that we'll know there's a flap missing or uh--yeah, right. All those uh, neat kind of things back there.

-- Uh, cockpit door open on the demo. Right?

While these data on his discomfort with authority were subtle, incidents subsequent to the briefing were much less so.

Other significant events. After the first briefing, the captain and crew walked down toward the gate to wait for the aircraft. It, like numerous other flights that night, was late because of a driving rainstorm over the entire area that was backing up the ATC system. The terminal was in a

similar state of disarray with wall-to-wall would-be passengers. In fact, the terminal was so packed that the flight crew elected to walk outside in the rainstorm rather than try to get through the crowd inside.

Shortly after arriving at the gate area where the entire crew reformed behind the counter, an irate customer became loud, vulgar, and abusive toward the gate attendant. One of the crew flight attendants, when asked by the researcher what could be done, explained that they could have the customer arrested or denied boarding but that all it usually took was for the captain to walk up to an upset customer and he or she would calm down. At that same instant, Captain Brent proceeded to the gate and walked outside of the terminal and stood on the tarmac where the aircraft had still not arrived. There were some surprised expressions on the faces of the crowd. Brent approached the angry man, who left him and walked away without incident.

In keeping with the traditional role of the captain, the mandatory duties of the captain, Captain Brent gave no instructions to the flight attendants as to how matters should work together. He gave no instructions regarding takeoff or landing, saying nothing about any extra procedures or duties the crew might be required to perform on their own.

As matters were under control, Captain Brent would not even exercise the authority required with duty. In one such

situation, Captain Brent refused to exercise his legitimate authority and responsibility when it was sought from a

member of the crew. The last leg of the flight was a late night departure from Chicago to Phoenix. Before pushback, a flight attendant entered the cockpit and told the captain that a passenger refused to wear his seatbelt. Captain Brent said, "Well, have you told him it's a regulation?" to which the flight attendant replied affirmatively. The captain then said, "Well, that's about all we can do is tell 'em," and then he turned back around in his seat. The flight attendant wheeled and walked from the cockpit without comment and no other comments about any subject were made by any of the cockpit crew until after the captain called for the checklist.

In one way, Captain Brent's behavior was the opposite of Captain Barry's. Where Captain Barry was the quintessential dominant authority, Captain Brent often refused to accept the authority of his role. No emergency situations occurred in which the exercises of authority might have been critical. Whether Captain Brent would have changed his behavior in such circumstances is, therefore, unknown. Also unknown, but cause for concern, is whether the crews, having witnessed his reluctance to exercise authority, might have proceeded on their own in an emergency situation, unwilling to wait and see. That also could have caused problems.

Captain Bill

Captain Bill was the most unusual individual observed. As with the other captains, his flying skills were perfectly adequate. But interpersonally, and as the leader of a group, Captain Bill exhibited behaviors that blocked and isolated him from the group. Even during my initial telephone conversation with him, his mannerisms and verbal patterns were inappropriate for the conversation and the subject matter. As soon as I had introduced myself and stated that "I was conducting research in conjunction with NASA and the Company," his response was, "Okay! Alright!" which struck me as either inappropriately enthusiastic or as if he was responding to something other than what had been said. Later in the conversation (as we were arranging a place to talk prior to meeting the crew), he suggested that he would prefer to meet me in the Flight Planning room rather than in the normally designated location for the crew briefing. While not typical, this suggestion did not seem unreasonable since he might want to check the weather or other aspects of the flight prior to meeting the crew.

At the appointed time, I waited in the Flight Planning room on the side of the central table where the 727 crew materials were located. Not knowing what Captain Bill looked like, but knowing that I was the only one in the room not in uniform, I deliberately made eye contact with everyone in the room, even those working elsewhere with

materials for other aircraft. As crew show time arrived, and no one had yet acknowledged my eye contact as if they were expecting to meet someone, I decided to go to the briefing room, assuming that Captain Bill had either forgotten about our meeting or had been delayed. The latter seemed more likely as no one had seen him yet, including his own crew which was already assembled and easily identifiable. (There was only one other crew in the room and their captain was already conducting the briefing.) Several minutes later a captain, whom I had observed earlier working in the Flight Planning room (and with whom eye contact had clearly been made since he was directly across from my position) walked up to the group and asked if they were going to Dayton. It was Captain Bill. In confusion, I approached him and introduced myself. His comment was, "I thought we were going to meet downstairs?" I explained that I had been down there and had seen him but not knowing what he looked like among dozens of uniform-clad captains, had merely stood by. Captain Bill said, "Well, no big deal, I guess I didn't see you."

The crew briefing. Captain Bill's first briefing, such as it was, took only 26 seconds (total time, including crew introductions) and covered only the mandatory items. He did enter the group's pre-formed boundaries, if only briefly. His briefing is presented in its entirety:

Captain: Well, has everyone introduced themselves?

Crew and RCG introduce themselves to each other.

Captain: Alright, I guess that's about it for the social hour. The weather's good. The plane's good. Let's go have fun.

With that Captain Bill turned and started off. I caught up with him and explained that I had talked with the crew briefly about the research but wanted to speak in more detail to the other two cockpit crew members and needed to obtain their permission to use the tape recorder in the cockpit. Captain Bill's response, heard earlier and then repeatedly throughout the day: "Okay! Alright!" Again, I stressed the importance of informing the crew about the nature of the research, and Captain Bill said that it would be better to talk to them in the cockpit because "nothing gets done in the social hour anyway."

The captain's portion of the 26-second briefing lasted only 16 seconds. More importantly, he showed none of the characteristics observed in the briefings of the A captains. He described no tasks to be performed involving interface (whether to be performed by him, the cockpit crew as a whole or the flight attendants), did not define or expand boundaries, and reinforced no norms (with the possible exception of the implicit norm that "the less I have to interact with you, the better"). In terms of authority, there was no display of technical or social competence and no counter-balancing of the traditional authority inherent in his role. There were no behaviors on his part which might engage the crew (only 10 seconds of the total briefing time was with "others talking" which was the crew

introducing themselves to one another).

Captain Bill was one of the two Captains in the sample whose second briefing was different than his first. His second briefing was longer than the first one (127 seconds total time) but it provided evidence that quantity alone was not the key to building a crew as a team. It too was preceded by an unusual encounter, but this time it was with his own FE rather than the researcher. Captain Bill came into the briefing room and, instead of looking for his crew, stood looking at the bulletin board. He and several other pilots began to complain about a scheduling policy. The FE, who was assisting in the crew scheduling department, empathized with their complaints and tried to explain the policy. Captain Bill turned to him and began a verbal attack on the policy and on him personally for not doing something about it. The FE tried to explain that he did not make the policy but only assigned hours in accordance with it, but Captain Bill repeatedly accused the FE of injustice (toward the captain, personally) and lack of wisdom. Finally, in the face of repeated badgering by the captain, the FE stated that there was nothing he could do and the captain should take it up with one of the company executives. The captain said, "What good would that do?" and walked out of the room. It was five minutes after show time and the assembled crew, listening to this exchange from across the room, turned back around and continued their prior conversations.

When the captain still had not returned 15 minutes after show time, the FE stated that he thought he had better go down to the airplane, and departed. (Interestingly, he made this statement not to the flight attendants seated together or even to the FO standing at the bulletin board, but to the researcher.) Shortly after that, the captain reentered the room but the crew continued their conversations. Rather than move into the group which had plainly formed around the coffee table and sofas, Captain Bill stood off to one end and behind the longest sofa, well away from most of the people (see Figure 4-4). The distance between the sofa and him was approximately 10 feet. Not only did he spatially distance himself from the rest of the crew but he spent most of the time while he talked looking into his flight bag on the table beside him.

Insert Figure 4-4 about here

When the captain finally got the crew's attention, he proceed with the most unusual crew briefing heard before or since. Here is the complete transcription:

Captain: Hello. Basically. Who's going to be the A today? Does everyone know everyone? I don't know, I used to know but I forget. It's a sad situation. I remember Rebecca cause she's funny. (Rebecca chuckles.) But, uh, you know Larry (the FO)? Everyone know Larry? Have you met Bob? Bob's our guest today.

Several crew members, male and female, respond:
Yeah, we know Larry. We know Larry. It was
Larry's birthday in Pittsburgh. (Chuckling.)

Captain: Okay. Uh, I'm going through the change
of life so bear with me, alright? But, uh it's
going to take us 52 minutes to get to Dayton. I
don't know what they're going to do about Joyce.
We'll head out to the plane; it's at Gate 20, uh,

Male: Joyce must be on her way, she's not home.

Captain (Note: The tone and verbal inflection in
this following section were in a rhythmically
fluctuating pattern between low and high
monotones): Okay. So let's just kind of head out
and we'll do everything as per the Manual and uh
we'll be doin' everything according to the house;
that works fine, and let's have fun and whatever
you normally do, that'll be fine, you know you
always tend to close the door like a minute or two
late because we don't mind being late; it's okay,
so we'll try to do that and we'll tell you what
we're doing if you'll tell us what you're doing,
and it should be nice weather. You guys have
anything for me, anything you want to do, you
know, special things to do, like throwing-up on
final?

Female: Like what?

Captain: Oh, uh, I throw-up alot you know.
Usually towards the latter part of the flight, you
know. Well, we're going to go down to the
airplane and we're going to wait for Joyce. Is
that it, we're not going to replace her? We're at
Gate 20, so if uh you'll give us a call if it
looks like there's uh a problem we'll just kind of
get ready.

Male: I don't think there's a problem.

Female: Really?

Male: Joyce is on the next bus load probably.
You wanna see what happens?

Captain: I think that's only fair. All right. I
had to go and talk to God for a minute there; He
was losing it. Okay, Larry, I've got the
paperwork, so see all you guys down there.

Female: Okay.

Captain: Ta Ta.

Captain Bill then walked out of the room by himself, leaving a crew in silence and a puzzled researcher in his wake.

Not only was this the most unusual briefing observed but it was also the most difficult to categorize. Obviously, it does not fit the pattern of an A captain in any regard. Tasks were rarely or confoundingly mentioned ("you know you always tend to close the door like a minute or two late because we don't mind being late; it's okay"), boundary issues were not discussed and the captain never entered the spatial boundary of the group, the group was certainly not engaged by the captain (other crew members talked for a total of only 22 seconds), and whatever norms were transmitted defied normal categorization.

Among the more puzzling characteristics of the briefing were his references to vomiting and having to "talk to God (because) He was losing it." Such tangential speech would, at least, communicate a lack of social skill or insensitivity to the feelings of others and could well be indicative of the kinds of behaviors exhibited by those who are often difficult to work with in a group setting.

Other significant events. Consistent with his early behavior, Captain Bill was not integrated in any of the crew behaviors, including flying. He gave absolutely no briefing to the cockpit crew in terms of how members should interact, and his takeoff briefs were as short as his first crew

briefing (e.g., "Standard [Company] takeoff and departure. Any questions?"). Not unexpectedly, there continued to be virtually no exchange between Captain Bill and the FE on the two legs observed.

The overnight behavior was no exception in that it was exceptional. As the crew entered Dayton operations and the flight attendants sat down at a table to complete their paperwork, the FO and FE sat down with another crew and chatted. Captain Bill sat alone in a chair in the aisle, pulled a portable "Watchman" television from a bag he carried, extended the antenna, and watched a program while listening to the sound on headphones.

Upon arrival at the hotel, Captain Bill went directly to his room. His only parting comment to the crew was, "In the lobby 15 minutes before show time." He neither ate with the crew nor socialized with them in any observable way. None of the crew reported seeing him at all until he appeared in the lobby at the appointed time. The FO and FE had breakfast with the researcher and hesitated to talk about the captain at all, (which incidentally, was not the case for the crews of any of the A captains). The flight attendants were not so reluctant and made several uncomplimentary remarks about him and his behavior.

As with most crews, there were no situations which demanded integrated and coordinated team work beyond normal routine. Predictions of this crew's performance in abnormal conditions would, at this point, be purely speculative. But

one thing is reasonably certain. Unlike Captain Brent's behavior (and to some degree Captain Barry's) Captain Bill's behavior was not subtle. It was noticeably different right from the beginning of crew life and lacked subtlety throughout. It also appeared that, in a strange way, Captain Bill's crew formed a well-bounded group, if not a team. Unfortunately, Captain Bill did not seem to be much of a part of it.

Captain Burt

All of the captains discussed thus far, whether they were in the A or the B category, had some degree of internal consistency--their behavior in the cockpit was consistent with their early group behavior, albeit sometimes in subtle ways. Such consistency was not the case for Captain Burt.

The crew briefing. Captain Burt's briefings were very similar to the briefings of the A captains. His briefings were consistently among the longest of all captains observed and absolutely the longest in terms of time spent talking by the captain himself. Furthermore, they were much like the briefings given by the A captains in both content and style with only a few minor exceptions. A typical segment from his briefing demonstrates this similarity.

Um, let's bring the aft stairs up no later than 5 minutes prior to push - just check with anybody in the cockpit, okay, just to make sure there's no fueling or maintenance problem, okay? Um, when you're ready to board 99.9% of the time we're ready to board. Just check with anybody in the cockpit. Again, you do not need my permission to board, okay. Just check with anybody, make sure

there's not something unusual happening, occurring, okay? You're the boss in the back and responsible for the crew and the management of their time. Uh, let's see, two hours and thirty minutes going down, light winds, we should be able to make uh 35 minutes. I think we've got about, oh shoot, what was it, 40 minutes on the ground? Okay. It shouldn't be, it shouldn't be too rushed. Okay. Uh, oh signs. Okay, the No Smoking sign will always be your announcement. The seatbelt sign; we'll make all announcements associated with that. Okay? Um, again it's two and a half hours going down so pace yourself going down there. You know the minute the No Smoking sign comes off you don't have to leap up and drag out the carts and all that other stuff, you know, just you know, take a break, okay? The same coming back cause we've got plenty of time. Okay. Um, don't be strangers, you know you guys are more than welcome to come up at any time to have a smoke or a break or whatever or just chitchat, you know. Knock, or use your key or if you don't have a key or if it doesn't work just give us a call, okay? Anything for me? Anything you guys want to, oh, one last thing - the door. If you could just try to leave the door just like partially open, you know, so that I can kind of hear what you guys are doing in terms of timing, okay, so it's basically timing. And uh when you've got the cabin secured say "We're all ready to go or we're all cabin secure and out of town." Okay? Uh, the only other thing that I should mention is that uh try to maintain an awareness of where you are in relation to the ground especially if you're in the descent, okay, cause sometimes we do mess up and get the No Smoking sign the last couple of minutes and that's a real Yahoo you know. Back to the galley with the carts! So, you know, try to, you know, maintain an awareness to the ground. Of course you guys should have a pretty good feel for that. Okay? Again, if anything unusual happens, you know, please bring it to my attention, okay, and we'll take care of it right away. All right? Safely, professionally, on time, that's my order of priorities and having a good time.

By this time, the reader should have a feel for the similarity between this briefing and those of the A captains in terms of tasks (what the captain and the cockpit crew will do, and which tasks the flight attendants might perform

that have an impact on boundary maintenance), boundary issues (the cockpit door and boundary permeability), and norms (general guidelines for priorities and effective communications). In terms of authority issues, he showed a degree of technical sophistication but he did have a tendency to interrupt his own flow with numerous verbal pauses ("Okay," "you know," etc.). The A captains did not show this tendency, but neither did the other B captains. The only issue where Capt Burt seemed to be more like the B captains than the A captains was in lack of crew engagement, specifically for time in the briefing when other crew members talked. In both briefings, he was at or near the mean for the B captains in the amount of time during the briefing when others talked. Even with that, had the research concluded solely with his briefing, he would have been categorized as an A captain. But later, in the cockpit, he behaved in an entirely different manner.

Other significant events. Early on in the cockpit, Captain Burt continued his pattern of behavior similar to the A captains. He gave a thorough briefing to the cockpit crew, directed principally at the FE in terms of "checking on us." His cockpit briefing style is illustrated in the following excerpt:

Captain: Okay, since we are all together, lets do a little briefing, okay. Ah, obviously this is a three man cockpit, that's the way I like to run it. If you guys see me doing something unsafe, procedurally incorrect, or you just don't understand, I expect you to say something. I don't care how you say it, whatever, but ah, safely, professionally, on time is my order of

priorities. That's, ah, we won't do anything to compromise safety at any time, alright? Ah, it's Tom, right?

FE: Right.

Captain: Okay, Tom. Ah just read on the checklists. Make sure you get the proper responses from us, okay? If you think a checklist should be run, and it's not being run, well, say something, okay?

FE: Right.

Again, this briefing seemed much more in the style of the A captains observed in terms of sharing authority, expecting high levels of performance, and explicit normative communication.

In fact, on the first trip, the entire first day passed without any critical incidents which might change these first impressions. Likewise on the first overnight, responsibility for social activities was handled by other crew members but the entire crew went to dinner together. Captain Burt neither dominated the evening nor withdrew from interpersonal engagement.

However, the next morning, an event occurred which triggered a change in Captain Burt's behavior--a drastic change. As the overnight crew arrived at the airport, the 727 that had been brought in by the last crew of the previous evening sat on the ramp. From inside the terminal at this gate, there was only one door, but it had a sign over it marked with the gate number and then the letters A and B. As one walked through the door and down the ramp, the corridor split into two jetways: one that proceeded on

toward the Company aircraft and the other one that went toward another company's flight that was boarding at the same time. On the way out, one of the flight attendants had commented about how confusing that was.

In spite of several announcements regarding the final destination of the Company flight, one elderly couple had ended up on the wrong plane. Unfortunately, their error was not discovered until the pushback had already begun. When the A Flight Attendant entered the cockpit to tell the cockpit crew about the couple's predicament, Captain Burt flew into a rage. He turned and screamed at the flight attendant. He yanked open the side cockpit window and yelled down at the ground crew to stop the push (rather than using the connected ground interphone). He violently cursed the "two stupid old sons-of-bitches." When the FO asked sheepishly if he should have the tug pull the aircraft back to the gate, Captain Burt screamed his opposition. "Hell no! Make them go down the aft airstairs and walk across the ramp. That'll teach them a lesson." When the flight attendant asked what they would do if the couple had checked baggage, the captain continued his tirade, and said it would be "a cold day in hell before I'd open the baggage compartment, even if they never got their god damned luggage back." Happily, the elderly couple had no checked baggage.

After the unfortunate couple left the aircraft and the taxi resumed, the captain's invectives continued. His tone remained abusive no matter what the subject matter

throughout the remainder of the flight. Comments from the other two crew members were limited to required responses. Other than the rantings of the captain, there was no conversation and none of the flight attendants entered the cockpit. When Captain Burt "ordered" the descent checklist, the FE meekly started down the required items, the plastic card trembling in his hands. The captain turned to him and told him loudly to "speak up" and followed his order with more of his diatribe. Upon arrival, I departed the aircraft with some degree of relief. The hostility had become oppressive.

As incredible as it may seem, a similar event occurred on the first leg of the second trip with Captain Burt. After another thorough and amiable briefing with a different group of people, the crew boarded the aircraft and prepared to depart only to be informed by the ground crews that the flight would be held at the gate for connecting passengers. Once again, the captain's ire was heightened--although at a slower rate than before. Then, after waiting approximately ten minutes, one of the boarded passengers came forward to the cockpit door and questioned the wisdom of holding a flight for one or two passengers when a plane nearly full of people would be delayed at the destination. Captain Burt looked back over his shoulder and told the inquirer that he perfectly agreed with him and that he thought it was stupid too. As the passenger returned to his seat, the captain exploded again within the confines of the cockpit. "Go sit

down you old bastard. Who do you think you are to tell me how to run this airplane. If you think you're so god damned smart, go talk to the president." Captain Burt demanded that the person in charge of the gate report to him in the cockpit, and proceeded to berate her even though she claimed to have only relayed the gate hold instructions from another source.

Once again, the derisions continued on the flight out. Ironically, "flight" also best describes the crew's behavior upon arrival. The flight attendants disappeared and the FO volunteered to do the walk-around with the FE. The return flight was silent. That seemed a reasonable coping strategy for working with a captain who was so unpredictable. But it is questionable if that strategy was appropriate for effective cockpit crew work.

The B Captains: Summary

None of the B captains' overall behavior was similar to the patterns exhibited by the A captains. Three of the four B captains deviated from the A captains in the early moments of the crew formation and their behavioral patterns remained consistent in subsequent crew performance. The fourth B captain followed the general pattern of the A captains in the crew briefing but deviated significantly from their behaviors in the cockpit.

There was only one variable that distinguished the entire group of B captains from their A counterparts. None

of the B captains exhibited the kinds of behaviors that actively engaged their crews. This was most clearly seen in the significantly smaller amount of time during the briefing in which the other members of the crew participated by speaking. Other than that, the four B captains deviated from each other nearly as much as they deviated from the A captains. In spite of these wide deviations, each B captain failed to produce and maintain an effective cockpit team.

Summary of the Results

The purpose of the research was to answer three questions, and those answers best summarize this chapter.

What Do Captains Actually Do in the First Few Minutes of Their Crew's Formation?

In all cases, the first meeting of the captain with his crew was at the "crew briefing" as outlined in the company's policy manual. Two overall conclusions can be drawn regarding the captain's initial briefing.

The "Crew Briefing" is a Misnomer

Each captain held the required initial crew briefing, but little if any of its content had to do with how the cockpit crew was to work. Instead, the briefing was for the cabin crew. Nonetheless, the FO and FE are able to discern a great deal about the captain as a crew leader by observing his presentation to the flight attendants. There may or

may not be a cockpit crew briefing that addresses the tasks, boundaries, norms and authority dynamics for the work to be done in the cockpit. If there is one, it is conducted in the cockpit prior to takeoff.

Each Captain has His own Style

Somehow, each captain develops his own style for handling a briefing and sticks with it. Across crews and across times, his briefing will be generally the same in overall content and style.

Question Two: Do Captains Who are Known for Their Abilities in Effective Crew Management Behave Differently than Their Less Effective Peers During Crew Formation?

The answer is decidedly, "yes." Some of the patterns were rather subtle and some were not. But in both cases, the data revealed early differences between the captains who had been nominated as effective crew leaders (the A captains) and those who were viewed as less effective (the B captains).

The A Captains

Although each of the A captains displayed his own unique style, there were several features common to them all.

Task statements. Each A captain talked about interface tasks and usually provided the rationale for whatever

statements they made, giving special emphasis to ways cockpit tasks might affect the work of the cabin attendants. If overall crew duties were discussed, this usually was done in a general rather than specific manner and included broader definitions of the task. Autonomy for performing tasks was sometimes delegated to the group as a whole but most often to the "A" Flight Attendant.

Boundaries. For the crew briefing, all A captains entered the physical boundaries previously established by the flight attendants. In all cases, the FO and FE remained outside this immediate boundary which permitted them to act as observers of the captain's behavior with the group. In essence, they could learn much about the way this captain was going to work even though the content of the captain's briefing had little if anything to do with the work that they were to do.

All of the A captains talked about managing the physical boundary that divided the cockpit crew from the flight attendants--the cockpit door. Although the specific instructions varied, the fact that it was always discussed was an acknowledgement of the importance of the interrelatedness and required interaction between the two groups. Beyond the boundary maintenance required for the cockpit door, all of the A captains explicitly discussed the "open cockpit," and made sure that the flight attendants knew that they were welcome in the front. This has implications beyond the mere social permeability of the

boundary, in that it may well increase the comfort of cabin attendants (or the other cockpit crew members) in passing information to the captain. It may reduce the resistance associated with having to pass bad news up the chain of command. "Bad news" can be critically important in an aircraft cockpit when all the information is needed for effective decision making.

Not only was task autonomy delegated to the "Lead" Flight Attendant, the A captains also designated the "Lead" to serve as a "linking pin." This designation carried with it a two-way responsibility: (1) to transmit information from the cockpit to the cabin and (2) to collect information from the rest of the cabin crew and relay it to the cockpit. Furthermore, it was not uncommon to find the FE specified as a "linking pin" in the other direction. This is consistent both with the FE's physical position in the cockpit, and with the functions he performs in controlling the environment of the cabin itself (e.g., temperature and pressure).

All of the A captains demonstrated implicit awareness of the boundary of the crew as a whole by introducing the researcher and mentioning something about the nature of the research. This helped to validate the presence of an extra person and to include his function as one consistent with the objective of the crew rather than something requiring special attention. The researcher typically was characterized as a resource, and never described as having

an evaluative role.

Norms. All of the A captains made explicit statements concerning the normative behaviors expected of their crew, even though the content varied. However, across the group, three subjects predominantly emerged: (1) safety, (2) effective communication, and (3) cooperation. In all cases when the particular subject was mentioned by the captain, it was explicitly stressed as being important and the rationale or an example of its importance was provided. The norm that the individuals occupying the roles were important resources was communicated more subtly. The most universal method observed was to encourage crew member input in the briefing and engaging them in the briefing process (a subject also noted in the next section).

Authority dynamics. All of the A captains engaged in behaviors which tended to balance the predisposition of the crew members to relinquish authority to the captain. Two means were generally used to accomplish this.

a. Establishing competence but not perfection. Competence sufficient for trust was established by presenting an orderly briefing, by displaying technical ability and by behaving in a manner that indicated some degree of social skill. Absence of perfection was typically demonstrated by the captain by admitting that there was some item of information which he did not know. This was never an item of information required for adequate performance but was usually something that could easily be obtained by any

member of the crew who would take the appropriate initiative. Not only did this demonstrate the absence of omniscience by the captain but it encouraged the responsible seeking of information by the crew.

b. Engaging the crew. The A captains engaged the crew in the social process of the briefing. One indication, if not cause, of the level of engagement was the amount of time that the captain spent with the crew in the briefing period when he was merely listening to others (as opposed to the time when he was talking to the crew). While some of this time was spent by merely listening to the crew's social conversation, other portions resulted from direct solicitation for input by the captain. Another characteristic of the process of engagement was the "real-time processing" of group events by the captain. Rather than presenting a one-way briefing that could have otherwise been provided on a video or audio tape, the A captains responded to the unique characteristics, behaviors, and comments of the crews with whom they were to work.

The B Captains

Captain Barry. This captain's behavior can be best summarized as "overcontrolling." In the briefing, his task instructions were not general but specific and not about what his behavior would be but about how others should do their tasks. Like the other B captains, he did not engage the crew but demeaned them. His behavior was sexist and

paternalistic toward the women occupying the roles of flight attendants.

Captain Brent. Captain Brent avoided conflict. The primary behavior under his control that had the potential to increase conflict was the exercise of authority--so if at all possible, he avoided this. Even when the exercise of his legitimate and expected authority was appropriate, he would not do it. In the crew briefing, he made few declarative statements and when he did, he "tagged" them which negated their impact.

Captain Bill. This captain had difficulty interacting socially with the individuals he was assigned to work with and this difficulty spilled over into other aspects of his capability to legitimately influence the group's life. He never became a part of the group with whom he would work--either spatially in the briefing or psychologically at any time. His own definition of the purpose of the meeting held an hour before takeoff put him at a further disadvantage because of his lack of social skills. He repeatedly referred to the crew briefing as "the social hour," and questioned its utility. Given his conduct in the briefing, the utility of the meeting was indeed, questionable. His crew briefing, at its best, was short, and when it was expanded, it became more unusual. Lacking any of the four positive categories of behavior seen with the A captains, Captain Bill's briefing was a rambling dialogue of unrelated and tangential topics.

Captain Burt. Captain Burt was the only captain observed who's behavior in the early minutes of group formation was inconsistent with his categorization as a B captain. The crew briefing was very much in the pattern of the A captains, with the one exception being the lack of participative engagement of the other crew members as measured by time when they were speaking.

Question Three: Does There Appear to be Any Consistency
Between the Formation Process and What Happens in Subsequent
Line Performance?

For nine of the ten captains across 18 of the 20 crews observed, the behavior of the captains in the early moments of the groups' lives was similar to their behavior in the cockpit and throughout the duration of the observed periods. Again, the A captains as a whole continued to display behaviors that encouraged team performance.

In-cockpit briefings

Five of the six A captains conducted some sort of cockpit crew briefing where they discussed the manner in which the group should work. Typically, the patterns established in the crew briefing were continued. These included discussions of interactive tasks (or in this case, tasks to be performed by the captain which might impact the other cockpit crew members), boundaries and their management, norms for cockpit work, and shared authority.

Subsequent Critical Events

Just as the A captains had responded in real time to the conditions and people in the original crew briefing, so too, did they respond to the conditions and crew member behavior in subsequent portions of the flight. And they did this in a manner consistent with their earlier behavior in the briefing. If, for example, the captain said in the crew briefing that he would tend to slow down if things became hectic, that is precisely what he did in hectic situations.

There were also four other patterns that emerged among the A captains over the course of the observations.

Calmness in unusual situations. In the one emergency observed, the few demanding situations, and the numerous minor complications that occurred in the routine of line flying, the A captains remained calm. One could say that this aspect of the "Right Stuff" was both apparent and appropriate. Where rational behavior was most helpful for solving a problem or satisfying conflicting demands, these captains served as models of calm and rational beings.

Talking through mistakes. On occasions when technical mistakes were made, A captains would "debrief" or talk through the events leading up to the incidents. This happened even if it was the captain himself who had made the error. But no matter who was at fault, the objective was not to fix the blame but rather to understand what had happened. Furthermore, the goal of the discussion was

consistently to improve performance of the individuals and groups involved. Frequently, the resolution or "lessons learned" involved behaviors that each member of the crew could perform to preclude similar incidents from occurring in the future.

Coaching. In a variety of situations, the A captains engaged in behaviors that most closely resembled coaching. These "mini-seminars" were not directive nor did they deal with fundamentals. Instead they were times when tips or techniques were offered which might improve the finer aspects of flying. In keeping with the non-directive nature of the tips, the A captains often preceded the advice by a comment such as, "here's a method I found that helped me." Similarly, these techniques or tips were often preceded by a brief indication of imperfection to balance the authority dynamic, such as a description of an incident that they had been involved in or a particularly bad landing they once had made.

Relinquishing social responsibility outside the cockpit. All of the A captains observed in after duty periods participated in the group's social activities, but none of them directed it. It was another time for them to engage the members in the group's life when their authoritative direction was neither necessary or appropriate. One captain made it a point to designate the "Lead" Flight Attendant as the person responsible for the evening's activities.

Consistency, Even for the B Captains

Three of the four B captains maintained consistent patterns between the briefings and their line performance. Captain Barry, who overcontrolled the briefing, liked to demonstrate and even wager on his flying prowess while allowing only the minimum range of learning through performance for his fellow flyer, the FO. Similarly, he frequently directed the system tasks to be performed by the FE. He continued to control and direct the group's after duty hours activities and made himself the center of attention. Captain Brent, who would not exercise his legitimate authority, stood outside in the rain rather than intercede with an abusive customer. He would not tell a passenger that wearing a seatbelt was required. He never demonstrated the authority of his position which would have allowed the crew to develop sufficient trust. Captain Bill's social inadequacies were clearly apparent in the initial briefing--his self-imposed social isolation continued in the cockpit and in the subsequent group life. Any behavior which required group effort was shunned by Captain Bill. He gave no cockpit crew briefing and even his takeoff briefing was questionably adequate. He shared no after-hours social life with his crews.

Only Captain Burt, whose crew briefing was much like that of an A captain, did not continue his early patterns in subsequent line operations. Unfortunately, the shift in

behavior was (1) from appropriate (as defined by behavior of the A captains in general) to inappropriate, and (2) radical. In the cockpit on both observation periods, Captain Burt flew into a rage because of an external condition which more appropriately demanded intervention or action than explosive anger or venting.

Final Comments

Perhaps the most important and yet easiest to overlook conclusion is that the overall level of technical proficiency of all the crews observed was high. Regardless of whether the observation was of an A or a B captain (remember, they were categorized based upon their leadership of crews, not their "stick and rudder" flying proficiency) the aircrafts were flown competently and safely. Few errors were made and almost all of them were minor. Couple this fact with the additional observation that of the more than 113 hours of flying time, only a very small portion was demanding with one brief abnormal period, and you can begin to get a sense of why flying in a commercial airliner is such a safe means of travel.

Finally, one might conclude that there are some reasonably common strategies used by effective crew managers, and I would agree. One might be further tempted to conclude that about the only thing that the B captains have in common is "diversity," which hardly makes for efficacious categorization. However, I will argue that

there is a common thread running through their fabric of diversity and that thread is spun from the fiber of "control". That argument is the first issue for the next chapter.

Footnotes

¹ In discussing the behaviors to be presented in this section with Bill Kahn, he suggested that what I was seeing was a process of "engagement." In agreement, I acknowledge his help and label.

² Coaching behaviors might have appeared more than normally expected because two of the A captains also served as Check Airmen and on three occasions, the first officers were receiving IOE (checks as their first time flying in the right seat). Coaching was appropriate for those circumstances.

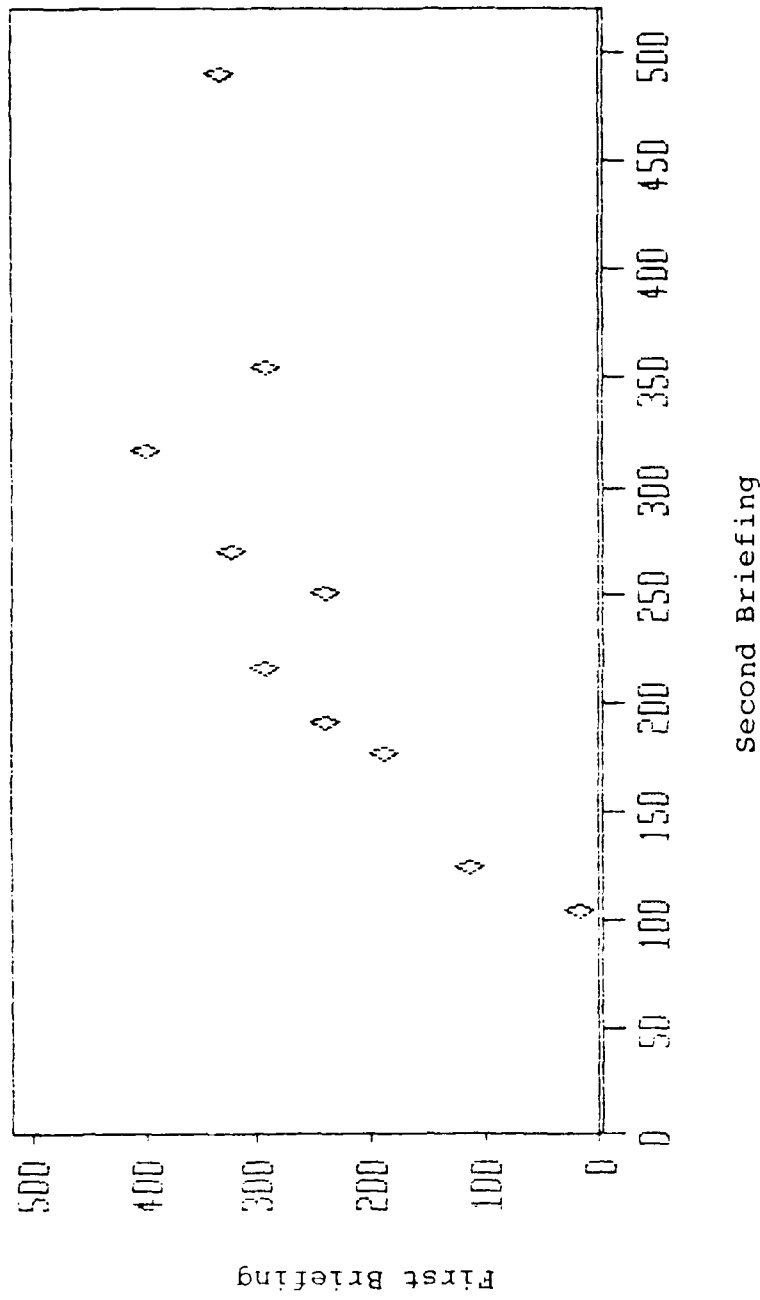


Figure 4-1. Plot of time (in seconds) for first and second briefings.

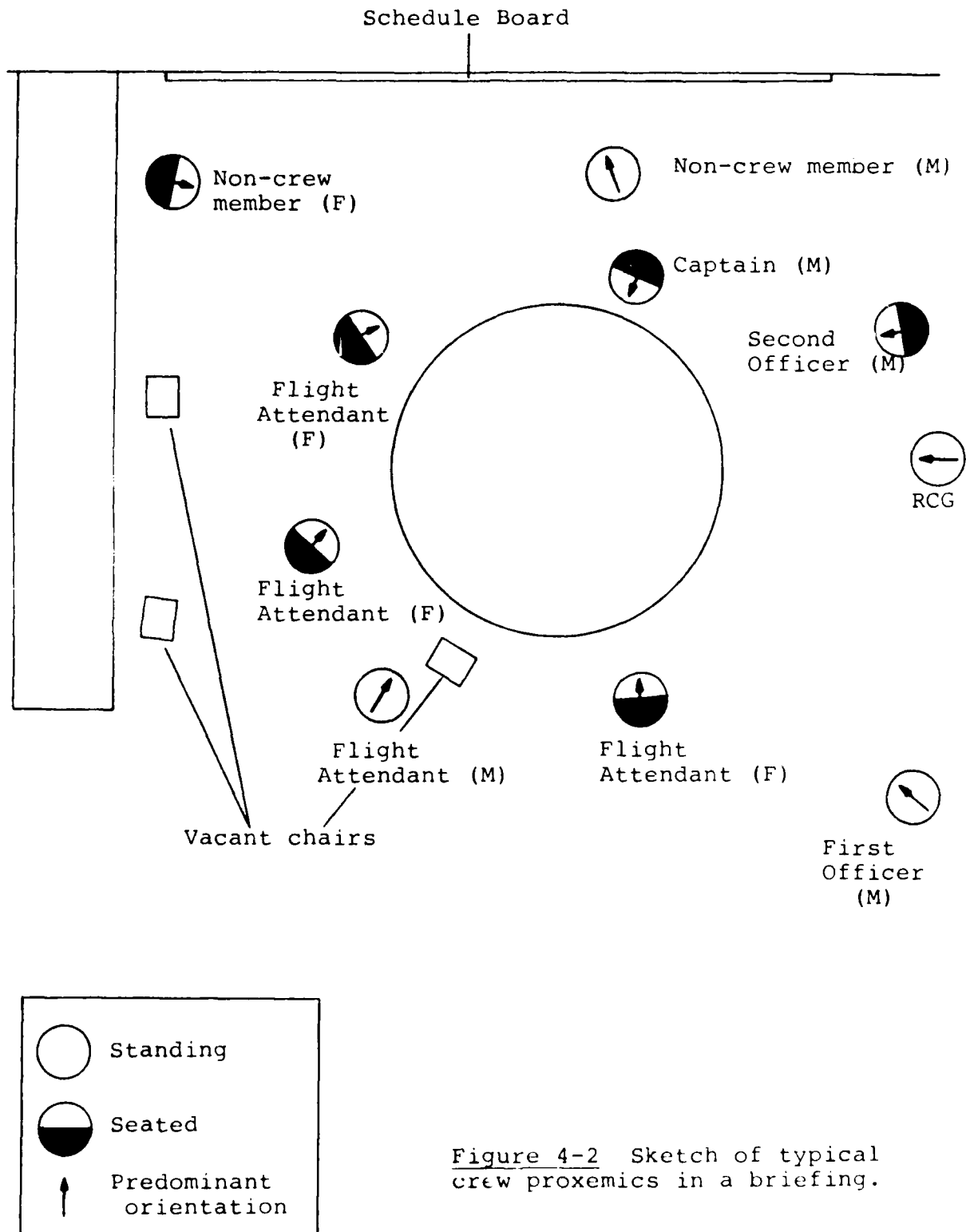


Figure 4-2 Sketch of typical crew proxemics in a briefing.

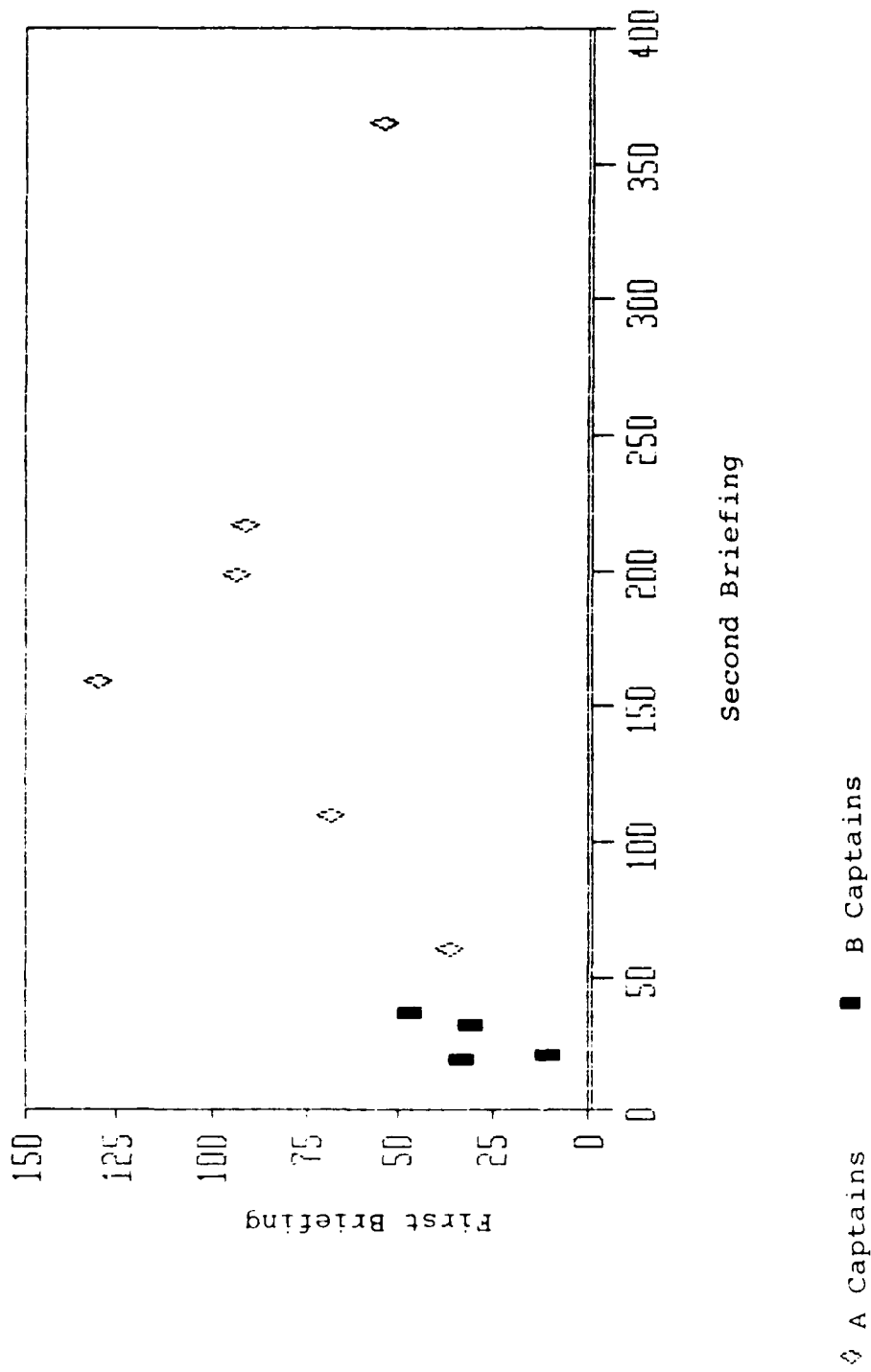


Figure 4-3. Plot of time (in seconds) that the crew members talked during the briefings for A and B captains.

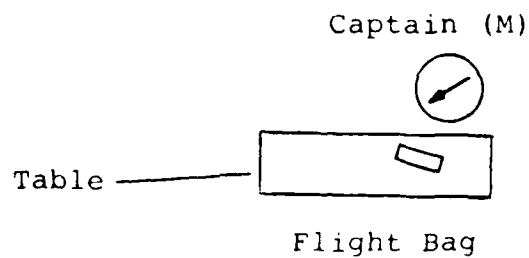
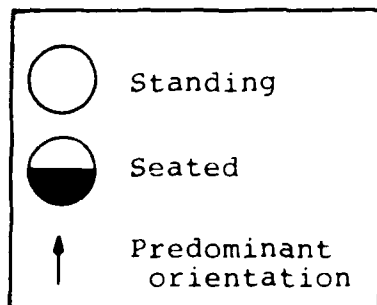
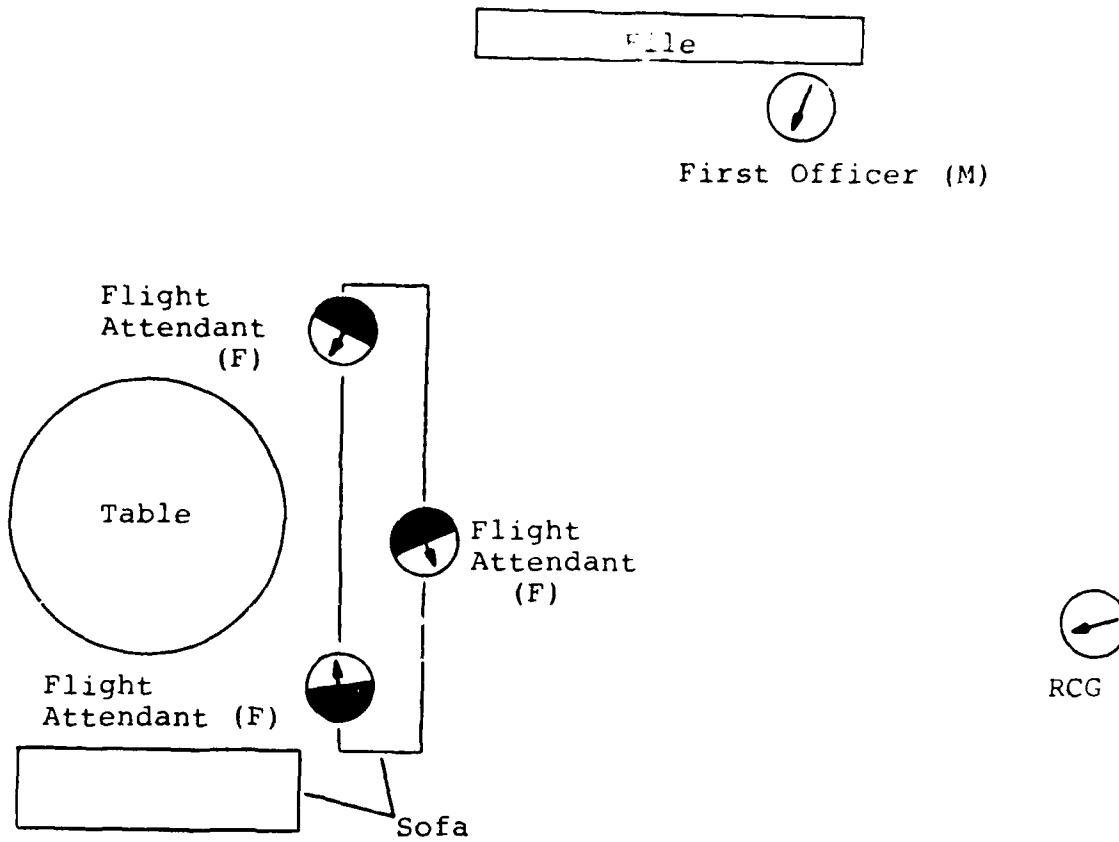


Figure 4-4 Sketch of crew proxemics for Captain Bill's second briefing.

CHAPTER V: DISCUSSION

Introduction

This final chapter has two goals. The first is to expand on the suggestion made at the end of the previous chapter that the B captains actually do have something in common beyond their obvious diversity. Having made that argument, the final task will be to present a framework broad enough to incorporate all of the findings. While based only on the data collected in this study, the framework will attempt to demonstrate the key elements that are imported from the organizational setting to the forming airline crew. Then, given these "pre-existing structures," it will be possible to see how the leader can mold these imported roles, norms, boundaries, and authority dynamics into conditions which will encourage effective team work.

Inappropriate Control:

A Thread that Unravels Leadership Effectiveness in Crews

If one remains at the individual level, it is difficult to discern much of a common pattern among the obvious diversities exhibited by the various B captains. It is like looking at piece of woolen cloth held close to the eye and seeing only red, green and blue fibers running in different directions. But if one stands further back from the material so that the whole cloth can be considered, it may quite clearly be identified as a tartan plaid pattern. Such is the case for the apparent diversity among the B captains.

In this case, mere distance from the individual idiosyncrasies might not be enough. I think it is useful to begin the search for a pattern by looking at a group that already appears to have some measure of commonality. In this study, that group is the A captains. Even here, a step away from the individual behaviors is necessary. Recall that each of the A captains contributed to the group's concept of the task, the boundaries, the norms, and the authority dynamics during the formation process. Yet none of them proceeded in a lockstep fashion. There was equifinality in their means--but there was commonality in their purpose. Their common objective as crew leaders was to produce effective teams.

The relationship between common purpose and equifinality might be considered analogous to the relationship between strategy and tactics. Strategy is designed to achieve a larger purpose or goal. Once that strategy is set, a variety of tactics might be used to achieve that goal. What is important in choosing the tactics is that they must contribute to the overall strategy.

Such is the case for the A captains. Whether in the briefing or in the cockpit, whether the situation was routine or demanding, the overall strategy was to create the conditions that would permit effective teamwork. The tactic that was required at any given point in time was a function of a great variety of conditions. For example, in the

briefing, the effective captain always engaged the crew members but how he went about that varied. For example, on the occasion where the A captain was flying with a new first officer, he noted that fact and suggested that the flight attendants could help the FO (and thus improve overall crew effectiveness) by "getting an early count." On other occasions when the captain had some experience with the crew of flight attendants, he might ask them to elaborate on what the cockpit crew could do to help them with their duties (and thus improve overall crew effectiveness).

Similarly in the cockpit, the strategy remained fixed even though the tactics were contingent upon the situation. Effective teamwork at cruise might be to have the FE check one of his manuals and determine whether a certain MEL might pose limiting constraints for an unexpected weather diversion. The captain might make absolutely explicit his expectations that the other crew members bring to his attention any errors or deviations they detect--or he might give orders to the FO in the event of an engine fire. But whatever the A captain does, it is always in the interest of the crew as a whole and its effectiveness. It at this level, where concern for group effectiveness is the overriding strategy, that we can see clear commonality among the A captains. And it is also at this level that the absence of such a strategy among the B captains comes into focus.

Lacking this clear direction and strategy aimed at crew

effectiveness, the B captains often chose tactics which do not create the appropriate conditions for effective group work. But merely identifying an absence of an appropriate strategy for group effectiveness is not enough. If it was, then we would have come full circle only to conclude that deviations from the appropriate strategy are harmful. But the purpose of examining the A captains was not so much to identify the basis of their commonality (as useful as that might be) as it was to provide an example of the group level vantage point from which we might examine the B captains.

The B captains did not have a common strategy aimed at crew effectiveness and I will argue that the principal reason was that they each had some difficulty with the construct of control. How and why each had difficulty with control was as varied as the tactics used by the A captains. So in a sense, both the A and the B captains demonstrated equifinality. The A captains demonstrated equifinality in pursuit of crew effectiveness while the B captains demonstrated equifinality in their personal struggle with the issue of control.

Over Control--Captain Barry

Captain Barry directed everything he could. In the briefing he gave specific directions to the flight attendants about what and how they were to do their work--so it would be done his way. He was paternalistic and sexist--both tendencies aimed at suppressing and

controlling others. These patterns continued in the cockpit and the tactics remained consistent--control, control, control.

There were no emergencies with Captain Barry's crews during the observation period. However, one might predict a crew failure with Captain Barry in certain circumstances. It is unlikely that these circumstances would occur or be discovered in a typical FAA checkride or even a simulator check because those evaluations test individual flying competence. In fact, under those conditions, Captain Barry would be expected to excel. If only one crew member could be in the cockpit, it might as well be Captain Barry because that is, in effect, the way his cockpit was operated. Therefore, one might anticipate crew failure for Captain Barry in circumstances where an overload occurred, particularly for some member other than him. The Ruffell-Smith scenario immediately comes to mind as the kind of crew overload in which Captain Barry would tend to fly the airplane and thus not be able to manage the crew's real problem. It is the kind of situation where the problem is too complex for one person to control all aspects. Compounding this is the tendency for crew members working with Captain Barry to become frustrated in their attempts to exercise initiative. The result of these frustrations is to quit taking initiatives and to psychologically withdraw from the work of the group. As described in the introductory chapter, one then "just sits back and hopes that (Captain

Barry) screws up." Over control can interfere with crew effectiveness.

Under Control--Captain Brent

Captain Brent failed to exercise a sufficient amount of control. As opposed to Captain Barry, who exercised control in situations where he had no authority, Captain Brent would not exercise control when it was expected and his role alone provided sufficient authority. There were even situations when he had the requirements written in regulations and company policies (such as the requirements for passengers to wear seatbelts) to back up his appropriate use of control--yet he would not exercise it.

Fortunately, there were no emergencies during the observed flights with Captain Brent. Because he was a certified captain, there is no reason to expect that he had not demonstrated his ability to make decisions in a simulator. But if it really was all on the line and some tough decisions had to be made quickly, would the crew have sufficient trust in this captain's ability in that regard? Or would they, having seen repeated instances of his aversion to command and control when appropriate, take action on their own. Would they decide that they were not willing to wait around and see? And if Captain Brent then did make a decision, what would be the consequences if it was different than the decision of the FO? Or what would Captain Brent have done if there was a serious difference of

opinion between the FO and the FE? What if a flight attendant really needed the captain's support and authority with an irate passenger onboard the aircraft? In effect, the abdication of legitimate authority might be the one condition which could lead to the crew behavior never seen--mutiny. More likely, given the long and rigid adherence to the ultimate authority of the captain, this crew might fail to arrive at a decision because the captain refused to make it in a difficult situation filled with conflict. If the captain does not exercise the minimal amount of control authorized by his position, the crew can not perform effectively.

Loss of Control from Within--Captain Bill

For Captain Bill, control problems did not involve application (i.e., over control or under control applied to the group setting). Captain Bill (as well as Captain Burt, next) had difficulty responding to certain types of issues. When those issues presented themselves, these captains responded in inappropriate ways regarding the control of their own behavior. Unfortunately for Captain Bill, the issues invariably presented themselves whenever the crew formed because the issue for him was the group itself. Captain Bill had difficulty engaging in routine social interactions and the stress of merely being in the group precipitated counter-productive behaviors. The fact that his role as captain required group interaction exacerbated

this difficulty. When faced with having to deal with the group, he failed to appropriately control his own emotional state which resulted in withdrawal (his first briefing) or the kind of inappropriate verbal patterns exhibited in his second briefing. Neither of these patterns is helpful in creating the conditions for effective group work.

Just as Captain Bill's behavior was difficult to categorize, so too is it difficult to make any predictions about the group's behavior if coordinated activity was required. But one thing seems clear. There was not a well bounded social group which included the captain. And if this crew engaged in appropriate behaviors involving tasks, roles, boundaries, norms and authority relationships, those behaviors must have been imported, for they were clearly not developed by this captain. The lack of control of his own behavior, driven by internal causes, prevented effective crew formation and, potentially, effective performance.

Loss of Control from the Outside--Captain Burt

Captain Burt also responded in a manner which adversely impacted effective group work. However, his inappropriate responses had different causes and appeared well after the group had formed. Captain Burt often behaved more like an A than a B captain. It was not until an unusual event occurred in the course of line operations that his inappropriate responses emerged. The triggering event was some deviation from what might be normally expected to occur

in the external situation confronting the crew . For example, it was an unusual event to discover that two passengers had boarded the wrong aircraft after the door had been closed and the push had started. This unique event required a unique response, but ranting and raving is not appropriate. It offers little in the way of creating appropriate conditions for crew effectiveness.

The clear problem for Captain Burt's crew was that "all bets were off." Whatever the crew had learned about the captain in the early moments of the group's life were apparently worthless. They legitimately could ask, "Whatever happened to "safely, professionally, and on-time" as briefed twice before? At least the first two norms were abandoned after the episodes which altered the standard routine. The FE's inability to call out the checklist items and the verbal pall over even the required cockpit conversations seemed to indicate that with respect to the working arrangements with this captain, nothing seemed appropriate. And the timing made it even worse.

At least the crews for the other B captains got some early indications of the captain's potential behavior and those early predictions turned out to be valid. They could predict his behavior and react accordingly, even if not appropriately for group effectiveness. But for Captain Burt's crew, it appeared that they suffered even more. It was as if they were less capable of performing even those routine behaviors that they should have imported from

training or other flying experiences. After the captain's explosive behavior, and especially after he screamed at the FE for his inability to even read the checklist, I found myself wondering if even individual skills would be exhibited in an emergency. The FE's behavior coupled with the silence of the FO and the absence of the flight attendants in the cockpit, presented the very conditions in which important if not critical information would be withheld from the captain. This did not seem to be exhibited as a form of punishment for his unprofessional behavior but simply because no one could predict his response at all.

Whatever the crew thought they had learned about the captain was apparently wrong. And to some degree, whatever appropriate behaviors that they might have imported had been diminished. So in this case, not only was crew effectiveness diminished, but compounding that was the demise of individual effectiveness when it was most needed. This may have been the most dangerous kind of crew situation of all.

Concluding Thoughts on Less than Effective Leadership

What these cases demonstrate is that group effectiveness can be impaired by inappropriate leadership behaviors. While the nature of those behaviors vary for these four captains, their effectiveness at leading and managing crew work was unraveled by a common thread spun

from the construct of control. Two of them inappropriately controlled their crews--one over controlled them and the other under controlled them. The other two inappropriately controlled themselves--one as a result of internal emotions and the other as a result of external events.

With this perspective, there is some commonality to the group of less effective captains. But it would be both helpful and parsimonious if an understanding of the behaviors of both the A and B captains could be incorporated within one framework. That task is the final goal of this discussion.

Toward an Integrative Framework

There are some general observations about the data that suggest several unanswered questions.

1. Even though the A captains as a whole tended to exhibit behaviors based upon group effectiveness strategies, none of them was the "super leader" whose mere presence in the room inspired great achievements. How is it that their early task, boundary, norm and authority behaviors were able to shift their crews toward more effective group performance?

2. The B captains, considered as a whole, did not seem to have similar early behaviors that caused their groups to be less effective (even though, as discussed above, they did exhibit a common "absence of appropriate strategy"). Yet even though each B group suffered from their captain's

behaviors, they were all able to work sufficiently well as a group to at least meet the standards of the clients (the passengers) and of the regulators (FAA). How is it that the captains' early behaviors, while negatively shifting the groups' behaviors, were not sufficient to destroy the groups' performance?

3. For all groups observed, there was only a short period of time for them to learn about their captain and the group with whom they would be working. The data show that there were behaviors to give them clues, but to obtain sufficient data to make judgments about relatively complex working arrangement in such a short period of time is expecting a great deal. Yet it does occur. How can that happen?

4. Is there not some way to consider the behaviors observed in a larger paradigm? Afterall, they were all captains in commercial aviation working for the same company. Should there not be a framework that can be used for explaining deviance in both directions and the subsequent impact on group effectiveness?

The unifying framework should be based upon the bedrock of the organizational observations. The objective of this final section is to describe just such a framework; one that will integrate the behaviors observed for airline crews and perhaps allow us some degree of extrapolation to other task groups which form in organizational contexts.

The "Shell"

Critical to understanding the proposed framework is a preliminary understanding of the newly envisioned concept of the "shell." Certainly the term is not new. In fact, if the term suffers at all it is because of its widespread use. Its use here combines applications from the physical science of chemistry and the modern science of computers. In chemistry, a shell is a space occupied by the electrons or protons and neutrons in an atomic structure. According to recent work, it is not possible to say at any given point in time where the subatomic particles are. Rather, the shell can be qualitatively pictured as the region of space where there is a high probability of finding the particle of interest. This last notion is of the most value in describing the shell in the organizational context. A shell for a group will not guarantee that every aspect will be established. It merely suggests that somewhere within the bounds of the shell, one might expect to find certain behaviors, roles, norms or dynamics occurring.

In computer science, particularly in programming, one also encounters the term "shell." In this realm, a shell provides a predefined set of interactions between various aspects of the system. Typically, these predefined sets of interactions occur between the computer and the operator. Users of MS-DOS will recognize COMMAND.COM as a shell. Analogously in organizational settings, a shell serves the

same function--it provides a predefined or expected set of interactions between various elements of the system which permits simpler and more efficient interactions.

The argument here is that a shell exists for the forming crew of a commercial airliner. The shell will be filled by a captain, a first officer, and a flight engineer and it will be linked to a team of flight attendants. This shell exists even before any of the individuals who will occupy the roles are assigned or are physically in place. It provides a considerable amount of the appropriate role behaviors, norms, boundaries and authority dynamics that the crew will use in their work. The shell facilitates the interaction between sub-elements of the crew and even within other system elements. But it is not rigid, nor is it absolutely defined. While it can provide sufficient structure as a minimum, it can be expanded. It can also be restricted to some degree. But these last two statements are elements of the process rather than fundamentals of the structure itself. Therefore, let us proceed in a more logical order to demonstrate how the concept of the shell emerges, the processes by which it evolves, and how it defines the behaviors of those who operate within it.

Four Phases in the Evolution of a Group Shell

There are four phases in the evolution and development of the operating shell. The first phase is defined by the external environment--it is what is there outside the organization. Likewise, the second phase is already in

place before the people arrive to man the crew but it comes from the way the organization defines itself, its purpose and its strategies. Phase three occurs in the early moments of the crews' lives. It occurs in the few moments before work when the teams are forming. It is the time of the crew briefing or first meeting--even if there is no formally structured briefing. Finally, the fourth phase is the core period in the shell when the crews perform their task. The degree to which the crew is facilitated or hampered in their on-line performance is in large part a function of the attributes of the shell that has been created.

Phase I: The External Environment

The most distant and yet most encompassing aspects of the shell accrue from the external context. It includes all those contextual elements that exist for all crews in all companies--it is the level of the shell with the greatest range of variables. At one extreme, these variables include the physical laws governing flight. To some degree it includes the constraints imposed by the technology of the cockpit. The shell is influenced by the authority dynamics that each crew member has learned (e.g., from his first flight instructor). It certainly includes all of the regulations governing the industry as a whole such as the Federal Aviation Regulations, the licensing body of the Department of Transportation, and the requirements imposed by the Federal Aviation Administration. It is impacted by

regulation and by deregulation. It is all of the constraints and demands that are there whether or not any particular company exists. It is the environment in which all carriers must operate. Because it is the largest and most structured, it is perhaps the most difficult to change. However, if change can be made at this level, it will have the most ubiquitous impact since it will impact all crews in all companies.

Phase II: The Intra-Organizational Environment

The external environment is shaped and redefined by the organization which calls itself an airline company and the result of this shaping and redefining can be seen at the crew level in the properties of the organizationally defined level of the shell. At the extreme here is the organization's definition of itself and its goals and objectives. Similarly, the management philosophies and policies, as well as the organizational design, effect the shell for the crew. Even the design of the aircraft selected for use by the company will impact the shell (or shells) that exist within it. More directly, the criteria for hiring crew members (as well as rumors about the criteria), the types of training and the selective emphasis of the various training options all impact the shell. A company that emphasizes and promotes programs such as cockpit resources management will produce different crew shells than one which does not even consider the concept.

And certainly the reward structure operationalized by flight standards will impact the shell. For example, if company interests are focusing on safety and cost savings, flight standards could emphasize avoidance of hot brakes and excessive brake pad wear. The Check Airmen would then critique or praise the application of reverse thrust until a particular lower speed had been reached, at which point brakes could be applied. As the word spreads that use of brakes is being checked, the shell will change to incorporate that expectation.

Phase III: Crew Formation

This is the phase where micro-process takes over from existing macro-structure.¹ It is the captain who breathes life into the shell which is filling with others who will play predefined roles. How well or how poorly the captain does in forming and leading his crew is in large part established in the course of the first meeting. This critical portion of formation will occur whether the crew first meets in a formally structured briefing, in flight planning, or in the cockpit. Abstracting from the existing data set, there are four categories which describe the ways in which captains perform these functions.

Elaborating, and expanding. These are the behaviors of the best of captains. They appreciate and exploit the opportunity for crew effectiveness provided them at the time of crew formation. They expand the existing shell and

create new ways to operate within and outside of its boundaries. They are the ones who expand and create new opportunities for constructive interactions among crew members. They tend to elaborate and enlarge the boundaries of the individual roles and of the group as a whole. They also create semi-permeable boundaries which can be useful later in the conduct of work on the line. They elaborate and expand the norms regarding safety, cooperation and communication. Under their leadership, new ways to share their authority emerge and hence the total authority of the cockpit and cabin expands and becomes more effective. They create the conditions which can lead to better crew performance than that which may already have been in place through the previously defined shell structures. These behaviors also tend to enlarge each crew member's concept of what the shell can be for an effective group and this improved image can be imported into the shells of subsequent crews of which they will be a member.

Affirming. Other captains affirm the constructive task definitions, boundary conditions, norms and authority dynamics which the environment and the organization have structured into the shell. These behaviors would not expand the shell but would help solidify the crew's understanding and acceptance of it. In effect, each crew member arrives with a shell that has generally defined appropriate crew behaviors in the past. The "affirming" captain "fills in the existing dotted lines" so that the crew can proceed with

the behaviors based upon their imported expectations. To the extent that the organization and the environment have provided a shell appropriate for group effectiveness, then the group under an "affirming" captain can be expected to perform well.

Abdicating. Captains who abdicate neither confirm the pre-existing shell nor deny it. They add nothing to the shell, nor do they confirm what the environment and organization have put in place. Crews under these kinds of captains are "not sure"--they are left with whatever shell they came in with minus any confirmation for its current utility or appropriateness. Not only is the shell for this particular crew left unverified, but each crew member's shell used for defining the role of "captain" is reduced because of this particular captain's performance. They leave with a "less clearly defined and potentially poorer" shell of what a captain should be. This is because it is very likely that the organization, if not the environment, has authorized the captain to clarify (and even modify) the shell and this captain has failed to do that. Therefore, extrapolations regarding his self-imposed diminished authority in a more general sense are apt to be the result. By abdicating, the captain has unwittingly exhibited some of the behaviors inherent in the final category.

Undermining. A captains who undermines actively countermands the conditions inherent in the shell that each crew member imports to the group situation. These are the

captains who, through their behaviors (including explicit statements), redefine in a more restrictive and unconstructive manner the tasks, boundaries, norms and authority dynamics which will guide the crew's operations. These captains create conditions that undermine group effectiveness. In a company that has established shells that foster effective crew work, "undermining" captains negate the pre-existing and positive shells. Not only can they reduce and restrict positive aspects of the shell by explicitly undermining them, but their general tendency to undermine is extrapolated to other areas of the shell that they do not mention. If a captain says that he does not want the flight attendants to get off the aircraft to talk to the gate people without his permission, the flight engineer who overhears this may well wonder whether he needs the captain's specific approval to conduct a walk-around. Worse yet, should he take the initiative to plan ahead for the crew's benefit or wait to see if it is "what the captain wants?" If a captain goes against procedures on one aspect of performance, what can he be expected to do on others? And even that is not the bottom line among the detrimental effects. Unfortunately, the reduced shells that result from interaction with an undermining captain may very well be subsequently imported to other crews with the same potential negative impact.

Prior to the briefing, we find a series of individuals, each with their own perceived shell for group behavior.

That imported shell is only that--a shell which the captain can enhance or diminish. He can expand it or undermine it; he can affirm it or abdicate. But when the briefing is over and the crew departs for the aircraft, they are a team of one sort or another. They may start work envisioning new and creative ways to improve team effectiveness, or they may be wondering what this trip is really going to be like. But in one form or another, this new team now has its own shell, one shaped by the tasks that were emphasized, by the boundary definitions that were described, by the transmission of implicit and explicit norms and by the authority dynamics demonstrated by the captain.

Phase IV: Task Execution

In this stage, the task is performed and the group functions (or malfunctions) in accordance with its newly defined shell. It is like a wagon rolling down a hill. Prior to crew formation, the conditions and variables from Phase I and Phase II had positioned the wagon at the top of a hill and on the path. In Phase III, the captain had the chance to give the wagon a push and get it rolling. He may have abdicated and left it sitting. He may have undermined it and pushed it off in another direction. But after the initial group formation, it has inertia from all three of the previous Phases. The wagon can be redirected, but it is harder to do now and takes more effort. Indeed, it will take some extraordinary behavior on the part of the captain

to change the group's behavior at this point--but it can be done. If the wagon is stopped in mid-course (as it was with the B captain who started off on the right foot but damaged the group's effectiveness later in the trip), then no one knows where it is going to roll next. Indeed crew members may be so confused by suddenly "not knowing" the course of the wagon (and their personal concern about being run over by it) that they may pay less attention to their own work thus contributing to a deteriorating condition.

Now the crew's ability to cope with the demands of the situations that are encountered will depend upon the conditions in place. If the situations are routine then even undermined crews have a reasonable chance to succeed as long as the elements undermined have not been critical. Said another way, since the shell has such structure from Phase I and Phase II, the undermining usually will leave intact enough remnants to handle ordinary conditions. The undermined crew is more at risk as the situations move to demanding or abnormal--situations which require more coordinated group work. Likewise, in these critical situations, an abdicated crew may not know where to turn or what to expect. But an affirmed crew can be expected to operate up to the standards in place and an "Elaborated and Expanded" crew can be creative in their work and can perform in manners even better than expected.

Implications

What can thinking about group formation from the framework of the "shell" offer us? If it is just another way to arrange the data, then it might not be worth the effort. The argument here is that the concept of the shell offers us not only a different way to arrange and understand the data about the formation process in task groups but that it also has implications for both theory and intervention.

Implications for Understanding the Data About Group Formation

One of the anomalies in the present data is the finding that even the effective captains fail to provide a detailed task definition and specific task instructions in the early life of their crews. In fact, the only captain who tended to shift toward greater specificity was one of the less effective captains--and this behavior was seen as contributing to his overcontrolling style. Yet much of the literature on task groups, including the model used as the basis for this research, suggests that defining the task is an important behavior for the leader to accomplish in the group formation process. And in some groups that is precisely what happens. In task groups of students in experimental social psychology laboratories (Hackman & Morris, 1975 for example) as well as in ad hoc task groups in organizational settings (Gersick, 1985) there were demonstrations of early task definition, or redefinition.

But this did not occur for airline captains in line operation. Why not?

I submit that the concept of the shell can help us understand such anomalies in group formation processes. First, one must not forget that the task under consideration is relatively routine. In that regard, it is much more like a production task (see Hackman, in press). Secondly, it is occurring in an ongoing organization. And thirdly, each of the members assigned a role within the shell is highly trained, evaluated, inspected, and licensed in the performance of the tasks associated with that role. It may be that when these conditions are met--i.e., when groups are forming in an ongoing organization with highly trained and experienced members performing a reasonably routine task--there is not really a requirement for the leader (or anyone else) to describe the task to be performed or lay it out in great detail. In this case, all members have imported a shell that carries with it a definition of the task that they have come together to perform. Instead of a specific task definition, what may be more useful is an expansion and elaboration of the shell--an exploration of how this particular group will work together within the same shell. These are items that the A captains did spend time on. Given that the crew consisted of trained people with a good working knowledge of both their specific tasks and the general group task, it would have been superfluous for the leader to dwell on task details. This clearly would not be

the case for students coming together to perform in a psychology lab experiment or for an ad hoc task group performing a task that is new to its members.

The concept of the shell can also help answer three questions asked earlier: (1) Why do effective captains not have to be "super leaders" to improve crew performance? (2) Why do crews led by less effective captains still manage to get their work done? (3) How do crews make sufficient judgments about the captains they are to work with in such a short time? Because crews in an effective organization import a shell based upon previously established Phases I and II, an effective captain does not have to start from a zero point every time. He has only to expand and elaborate on an existing effective shell. In the opposite direction, the behaviors of less effective captains do not destroy the entire shell. They may damage it but there is so much overlearning that the group can perform effectively most of the time. But in any case, the shell is so well developed for crews in a commercial airline company that they do not need a tremendous amount of information about their new leader. The roles are well defined for each of the members--including the captain. Given these conditions (which may be reasonably unique in the organizational world) of highly trained people performing a similar task with the same roles in each case, all that is needed are a few final details to affirm the shell. Enlarging it will take more work, while abdicating takes less effort. But the well

developed shell imported by commercial airline crews hastens the process of assessing the leader.

Implications for Understanding Task Group Leadership

As noted above, it would be inappropriate to extrapolate beyond the groups studied. However, the concept of the shell suggests that the leader can have an impact on the group's performance by creating appropriate performance conditions for the team at the outset. This is when the captain breathes life into the group--i.e., in Phase III of the shell during the formation process. Two leadership applications at this critical time in the groups' lives should improve crew performance.

Creating conditions. A leader can not make a group work well--at best he or she can give it every opportunity to work well. This is done, at a minimum, by affirming the constructive elements of the shell imported from the environment and the organization. More optimistically, he can expand and enlarge the imported shell in a manner which will enhance the opportunities and reduce the improperly perceived constraints. He can also expand the crew's view of their own potential so that external conditions may be more than just something to which they respond. A proactive crew can often shape the external influences to their advantage.

Building the team. If the "team" is going to do any work together, then there should be more than a collection of individuals filling individual roles inside the airplane

when the wheels come up. As noted in the behavior of crews led by captains who abdicated their functions of affirming the shell, the individual members usually can do the job. But if team effort and coordination are indeed required, then the team should be established as a performing unit early on. That is precisely what the A captains did through the processes of enlarging the shell and engaging the participation of individual members in the team task.

The captain can also have a continuing, although less critical, impact during the execution phase.

On-going process management. Just because a captain does his best to create the appropriate conditions for team effectiveness, it does not necessarily follow that everything will go smoothly from that point on. Situations are apt to occur in the course of a four day trip that may require the captain to constructively intervene in the process of the group if effective performance is to continue.

The shell can collapse if not managed in the real world. This is especially true for the fragile edges of an expanded or redefined shell. If an expanded or redefined shell is to become operational and passed on as a new version of each crew member's shell, then it must be continually reinforced. It is not sufficient for the captain to merely say that "if we get rushed, I will have a tendency to slow things down to avoid mistakes." He must, in fact, slow things down when external pressures mount.

From a post hoc perspective, the theoretical constructs offered here fit the data and provide a reasonable perspective for interpretation and application. Certainly, what is needed is broader testing of these predictions about task group leadership in other organizational settings and in other industries.

Implications for Theory

The construct of the shell has the greatest implications for our understanding of the formation processes of groups in organizational settings. As noted earlier, there are some clear differences between the formation processes observed for these groups compared to the laboratory groups and self-study groups that are dominant in the research literature on group formation and development. The environmental and organizational factors for the shell of forming airline crews is heavily laden with information. As a result, a long formation process is not required even though the individuals members have never met before. Such a well endowed shell also makes it possible for the leader to create the conditions which may enhance the team's performance in a relatively short time. Even if the leader is less skilled at team development, the well developed shell assures that some degree of team performance can still occur.

These data suggest that the time frame for group formation and development is a function of the amount of information imported in the shell. These forming airline

cockpit crews brought a great deal of the necessary information with them. A great deal of the team formation process for them occurred rapidly. At the other extreme, groups of students in a learning group (by definition) and patients in therapy groups do not know much about the task to be performed. In these groups, formation and development continues over the life span of the group. Somewhere in the middle lie the ad hoc task groups. Their first meeting is generally devoted to defining the task and developing a preliminary strategy. Half way through, the group comes to terms with the task, the potential approaches to the problem at hand, and perhaps the realization of their own mid-life crisis. They establish a final strategy which the group uses for the duration. Competent people in their own arenas come together with some degree of a shell, but one which is not nearly as complete as the shell for airline crews, because the task itself is not yet clear. Their formation and development process lies somewhere between the learning groups (with practically no shell) and the airline groups (with a highly developed shell).

At a minimum, or theories of group formation and development within organizational settings should incorporate the concept of the shell. Group formation and development may well be related to the task to be performed as well as the context and background preceding it. Finally, the shell concept reinforces the conclusions of Hackman and Morris that the contextual variables which are

controlled in a laboratory setting may, in reality, be of the greatest importance in affecting team performance. Phase I and Phase II of the shell development processes focus precisely on those variables and their power has been noted.

Implications for Application

The data and the concept of the shell suggest three areas for applications aimed at improving organizational and group effectiveness. First, the findings suggest that the shell and the information it carries should be examined in order to obtain some idea of the depth of group formation we might expect to see in an organizational setting. Secondly, within Phase III, it may be useful to diagnose the impact the leader is having on the group (e.g., enhancing, affirming, abdicating, or undermining). By using this categorization as a method of diagnosing the leader's behaviors in the group, it should be possible to help them change to a more constructive pattern. The data show that effective leaders can use a variety of tactics as long as they remain focused on the overarching strategy of group effectiveness. The less effective leaders each had one particular pattern that distracted from their ability to create appropriate conditions for group effectiveness. Diagnosing this inappropriate pattern would be the first step in correction.

Having done that, two strategies come to mind for assisting in developing the appropriate behaviors:

consciousness raising and skills training. Which of these strategies offers the most benefit would depend upon the diagnosis of the individual's problem. Some captains may be unaware: some may not recognize the importance of the the early moments of crew formation; some may be unaware of the impact of their own behavior on the group. For these captains, consciousness raising would be important in their development. It may, however, only be a first step. It is possible that they may not possess the necessary skills. If that is the case, then skills training can be structured to improve their abilities. These interventions would be made as a therapeutic intervention to correct problems. On an organizational level (related to Phase II of the shell) consciousness raising and skills training to improve captains' crew formation performance could also be emphasized in LOFT courses and as an integral part of captain upgrade training.

Lastly, the overall concept of the shell suggests various points of leverage for direct intervention to improve team performance. Policy setting at Phase I can clearly have the most widespread impact. For example, if the FAA endorsed the concept of cockpit resource management as a means to improve crew performance and then established procedures for ensuring policies and checks of its implementation on the line, all crews in all airlines would be impacted. But such systemic changes are slow to occur, often because of the political pressures involved. For

organizational practitioners, Phase II offers the greatest potential. By structuring the organizational context, by emphasizing training that supports awareness of crew issues and development of the appropriate skills for enhancing team performance, and by rewarding behaviors which enlarge and improve the performance shells, one might expect to see the greatest impact on group performance. Some companies have already recognized that crews do the work and have taken steps to incorporate these concepts. The data from this study support those decisions. And lastly, as the group forms in Phase III, the data show that the captain can make a difference.

Footnotes

- 1 Probably not coincidentally, the shell also incorporates variables from both the "macro" and "micro" perspective in organizational behavior.

APPENDICES

Appendix A

Letter of Instruction for Evaluators

Human Resources and
Space Administration
Ames Research Center
Moffett Field, San Francisco 94035



NASA-Yale Researchers

March 20, 1985

Captain Richard _____

Dear Richard:

In the last few years, NASA and the airline industry have become increasingly aware of the importance of crew coordination in the cockpit environment. The resource management section of your recurrent training is one important step in this direction, as is recent NASA research on group behavior in cockpits and space vehicles. We are now planning further research and would like to ask for your assistance as a Check Airman.

Enclosed you will find a rating form and a list of captains' names. The instructions are pretty straightforward. What I would ask you to do is to consider the ability of those on the attached list in building and managing their crew as a team. Only consider those with whom you have had direct experience. Select twelve whom you would consider to be most successful in this regard (the Upper third) and twelve whom you would consider to be the least successful (the Lower third). Then, place a "U" beside each name that you feel is in the Upper third and an "L" beside each name that you feel is in the Lower third. When completed, as many as 24 of the 37 names should be marked with either an "L" or a "U". Place the list in the enclosed Fed Ex envelope and have them deliver it to _____ who is maintaining the confidential data base.

As with all data collected for this research, your responses will be treated in the same confidential manner as NASA ASRS data. Therefore, I would ask for your cooperation in keeping it confidential as well.

Thanks again for your cooperation and assistance in completing the ratings.

Robert C. Ginnett

Appendix B

Briefing Script for the Captain and Crews

This script outlines the information that will be presented to each crew observed in the research study "Team Performance in Aeronautical and Space Environments."

Good morning, Captain _____ .

My name is _____ . I'm from Yale University and am doing research for (Airline Name) in conjunction with NASA. You may have already seen this letter (offer them a copy) from (Chief Pilot) describing our research here with (Airline Name). In short, our objective is to try to understand the ways that airline flight crews work in their natural setting -- in the cockpit. This is in no way an evaluation or rating of your flying performance.

Since we are interested in knowing about your normal crew behavior, no special actions are required or even desired. I am familiar with the aircraft and the FAA procedures for jumpseat observation, so you need not feel that it is necessary to explain things solely for my benefit. As much as possible, I'd like you to perform your duties as if I wasn't here, or if that seems difficult, as if I was an extra crewmember on for the trip.

I will be observing the flight crew as a whole and taking notes during the process. You and your crew should understand that any information from these observations is both confidential and anonymous -- that is, any information

I obtain will not be identified with this crew or any of its members, nor will any information be released which might be traced back to this crew.

If any member of the crew objects to the collection of data, either now or at any time in the course of the observation, I will of course honor that request. There will be no negative consequences for such a decision. As with any other data, that decision will also be confidential and anonymous.

May I observe your crew on this trip?

(If all members of the flight crew are not present, the following statement should also be made.)

All members of the flight crew should be aware of the nature of this research and decide whether or not to participate. If you would prefer, I will be happy to describe the research to them, and at your discretion, to other members of the crew.

Appendix C
Data Collection Sheet (Task)

Flt No _____
Date _____
Code _____

T A S K

	CONTINUING	EPISODIC
Abnormal		
Demanding		
Normal		

Appendix D
Data Collection Sheet (process)

	<u>P R O C E S S</u>	
	CONTINUING	EPISODIC
Abnormal		
Demanding		
Normal		

Appendix E

Transcript of the Explanation of Research to a Crew

As the captain introduced all of the scheduled crew members earlier in the briefing, he had also introduced me and noted that I was "going to kind of watch how the cockpit works and just kind of observe. He's totally independent; not with the FAA."

After having given a portion of his crew brief, he provided time for me to explain the research with the following introduction: "Bob will be with us today and tomorrow morning and I'll let Bob go ahead and tell you what he's going to do today.

RCG: Hi. I'm with Yale University and we're doing a research program that's sponsored by NASA. What we're trying to do is to look at the way groups work in the real world with all their normal interactions with other groups. Things happen to an airplane: maintenance, ATC, passenger situations occur normally, all the time. And all of those things impact the way that the crew works. What we're trying to do is see if we can't come up with some systematic way of observing the kinds of work that the group does rather than the work that individuals within the group do. NASA is interested in it both because of the aeronautics side and the space side.

The report will be available to (The Company) and to NASA. It's all protected data, just like the ASRS data if

you file a NASA report. It's got the same degree of confidentiality. The crew is only identified on my sheets by a code number and once it goes into our coding system, it's completely anonymous and confidential. What does that mean in terms of the individuals here? Say Hal says something about the company or the company policy. No matter how interesting that observation might be, I may make a note of it, but unless I hear that from enough other people that that's a pretty common indicator of what people feel, I won't use it. Even though it may sound like a really great idea that others should know about, somehow through some system unknown to me, it may come back to where someone might say "the only person who could have possibly known that was Hal."

Female: Oh yea, I see.

RCG: The most important thing is I'm not a Fed. So everything is confidential. What that means to you is--just behave normally. Just do what you normally do--that's what we're interested in learning about. One thing for you, Tom, (the first officer). I take a lot of notes and it turns out that from where I sit, you're the only person who can see all this note taking that's going on. It's not about you (laughter) but sometimes FOs get real anxious about all this writing going on. (laughter) If any of you have any questions anytime about what I'm doing, please ask and I'll be happy to talk to you about it--either during the day or tonight.

Female: You're going to be with us on the overnight?

RCG: Yea, through the day and the overnight and then back tomorrow morning.

Captain: (Continues his briefing.)

REFERENCES

- Alderfer, C. P. (1977). Group and intergroup relations. In J. R. Hackman & J. L. Suttle (Eds.), Improving life at work. Santa Monica, CA: Goodyear, 1977.
- American Psychiatric Association. (1980). Diagnostic and statistical manual of mental disorders (3rd ed.). Washington, DC: Author.
- Bales, R. F. (1970). Interaction process analysis: A method for the study of small groups. Cambridge, MA: Addison-Wesley.
- Bales, R. F. (1970). Personality and interpersonal behavior. New York: Holt, Rinehart & Winston.
- Bales, R. F. & Cohen, S. P. (1979). SYMLOG: A system for the multiple level observation of groups. New York: Free Press.
- Bion, W. F. Experiences in groups. (1961). New York: Basic Books.
- Burrows, W. E. (1982, December). Cockpit encounters. Psychology Today, pp. 42-47.
- Cooper, G. E., White, M. D., & Lauber, J. K. (Eds.). (1979). Resource management on the flight deck (NASA CP-2120). Moffett Field, CA: NASA Ames Research Center, (NTIS N80-22283).
- Dunphy, D. C. (1974). Phases, Roles, and Myths in Self-Analytic Groups. In Gibbard, G.S., Hartman, J.J., & Mann, R.D. (Eds.), Analysis of groups. San Francisco: Jossey-Bass.
- Federal Aviation Regulations. (1984). Seattle: ASA.
- Fiedler, F. E. (1967). A theory of leadership effectiveness. New York: McGraw-Hill.
- Fiske, S. T. & Linville, P. W. (1980). What does the schema concept buy us? Personality and Social Psychology Bulletin, 6, 543-557.
- Fiske, S. T. & Taylor, S. E. (1983). Social cognition. Reading, MA: Addison-Wesley.

- Foushee, H. C. (1982). The role of communications, socio-psychological, and personality factors in the maintenance of crew coordination. Aviation, Space, and Environmental Medicine, 53, 1062-1066.
- Foushee, H. C. (1984). Dyads and triads at 35,000 feet: Factors affecting group process and aircrew performance. American Psychologist, 39, 885-893.
- Gendlin, E. T. (1981). Focusing. New York: Bantam.
- Gersick, C. J. G. (1983) Life cycles of ad hoc task groups. Technical Report No. 4. Research Program on Group Effectiveness, Yale School of Organization and Management, Yale University.
- Gersick, C. G. (1985) The life cycles of ad hoc task groups: Time, transitions, and learning in teams. (Doctoral dissertation, Yale University, 1984). Dissertation Abstracts International, 46/05, 1742B.
- Gibbard, G. S. (1974). Individuation, Fusion, and Role Specialization. In Gibbard, G. S., Hartman, J. J., & Mann, R. D. (Eds.), Analysis of groups. San Francisco: Jossey-Bass.
- Hackman, J. R. (1976). Group influences on individuals. In M. D. Dunnette (Ed.), Handbook of industrial and organizational psychology. Chicago: Rand-McNally.
- Hackman, J. R. (1986). The design of work teams. In J. W. Lorsch (Ed.), Handbook of organizational behavior. Englewood Cliffs, NJ: Prentice-Hall.
- Hackman, J. R. (Ed.). (in press). Groups that work. San Francisco: Jossey-Bass.
- Hackman, J. R. & Helmreich R. (1984). Assessing the behavior and performance of teams in organizations: The case of air transport crews. Technical Report No. 5. Research Program on Group Effectiveness, Yale School of Organization and Management, Yale University.
- Hackman, J. R. & Morris, C. G. (1975). Group tasks, group interaction process, and group performance effectiveness: A review and proposed integration. In L. Berkowitz (Ed.), Advances in experimental social psychology. New York: Academic Press.
- Hackman, J. R. & Walton, R. E. (1985). The leadership of groups in organizations. Technical Report No. 6. Research Program on Group Effectiveness, Yale School of Organization and Management, Yale University.

- Hare, A. P. (1976). Handbook of small group research (2nd ed.). New York: Free Press.
- Harper, C. R., Kidera, G. J., & Cullen, J. F. (1971). Study of simulated airline pilot incapacitation: Phase II, subtle or partial loss of function. Aerospace Medicine, 42, 946-948.
- Helmreich, R. L., Foushee, H. C., Benson, R. & Russini, R. (in press). Cockpit management attitudes: Exploring the attitude-performance linkage. Aviation, Space and Environmental Medicine.
- House, R. J. & Mitchell, T. R. (1974). Path-goal theory of leadership. Contemporary Business, 3 (Fall), 81-98.
- Jacques, E. (1955). Social system as a defense against persecutory and depressive anxiety. In Klein, M., Hermann, P., & Money-Kryle, R. E. (Eds.), New directions in psychoanalysis: The significance of infant conflict in the pattern of adult behavior. New York: Basic Books.
- Janis, I. L. (1982). Groupthink (2nd ed.). Boston: Houghton Mifflin.
- Klein, M. (1946). Notes on some schizoid mechanisms. International Journal of Psychoanalysis. 27, 99-110.
- Labov, W., & Fanshel, D. (1977). Therapeutic discourse. New York: Academic Press, 1977.
- Mahler, M.S. (1972). On the first three subphases of the separation-individuation process. International Journal of Psychoanalysis. 53, 333-338.
- McGrath, J. E. (1962). Leadership behavior: Some requirements for leadership training. Washington, DC: U.S. Civil Service Commission.
- McGrath, J. E. (1964). Social psychology: A brief introduction. New York: Holt.
- McGrath, J. E. (1983). The study of groups: Group task performance and social interaction. Englewood Cliffs, NJ: Prentice-Hall.
- McGrath, J. E. & Kravitz, D. A. (1982). Group research. Annual Review of Psychology, 33, 195-230.
- Myers, D. C. & Lamm, H. (1976). The group polarization phenomenon. Psychological Bulletin, 83, 602-627.

- Nagao, D. H., Vollrath, D. A. & Davis, J. H. (1978). Group decision making: Origins and current status. In H. Brandstatter, J. H. Davis and H. C. Schuler (Eds.), Dynamics of group decisions. Beverly Hills, CA: Sage.
- National Transportation Safety Board. (1979, June). Aircraft Accident Report (NTSB Report No. AAR-79-7). Washington DC: NTSB Bureau of Accident Investigation. (NTIS No. N80-11051).
- National Transportation Safety Board. (1982, August). Aircraft Accident Report (NTSB Report No. AAR-82-8). Washington DC: NTSB Bureau of Accident Investigation. (NTIS No. PB82-910408).
- Pittenger, R. E., Hockett, C. F., & Danehy, J. J. (1960). The first five minutes: a sample of microscopic interview analysis. Ithaca, New York: Paul Martineau.
- Rosa E. & Majur, A. (1979). Incipient status in small groups. Social Forces, 58, 18-37.
- Ruffell-Smith, H. P. (1979). A simulator study of the interaction of pilot workload with errors, vigilance, and decisions. Moffett Field, CA: NASA-Ames Research Center, Report No. TM-78482.
- Schegloff, E. (1968). Sequencing in conversational openings. American Anthropologist, 70, 1075-1095.
- Scheidlinger, S. (1964). Identification, the sense of belonging and of identity in small groups. International Journal of Group Psychotherapy, 14, 291-306.
- Schutz, W. C. (1958). FIRO: A three-dimensional theory of interpersonal behavior. New York: Holt.
- Thomas, E. J. & Fink, C. F. (1963). Effects of group size. Psychological Bulletin, 60, 371-384.
- Tuckman, B. W. (1965). Developmental sequence in small groups. Psychological Bulletin, 63, 384-399.
- United Airlines. (1981). Command / Leadership / Resource Management, Book 1, Chicago: United Airlines.
- Vroom, V. H. & Yetton, P. W. (1973). Leadership and decision-making. Pittsburgh: University of Pittsburgh Press.
- Webster's new collegiate dictionary. (1961). Springfield, MA: Merriam.

Weick, K. E. (1968). Systematic observational methods. In G. Lindzey & E. Aronson (Eds.), Handbook of social psychology, (2nd ed.), (Vol II). Reading, MA: Addison-Wesley.

Weick, K. E. (1985). Systematic observational methods. In G. Lindzey & E. Aronson, (Eds.), Handbook of social psychology, (3rd ed.), (Vol II). New York: Random House.

Wells, L. (1980). The group-as-a-whole: A systemic socio-analytic perspective on interpersonal and group relations. In C. P. Alderfer, & C. L. Cooper, Advances in experiential social processes. New York: Wiley.